Model Engineer

THE MAGAZINE FOR THE MECHANICALLY MINDED

Butte

THE *CUTTY SARK* TAKES SHAPE

ONE SHILLING 4 APRIL 1957 VOL 116 NO 2915

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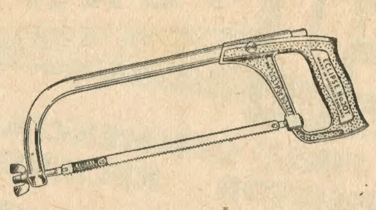

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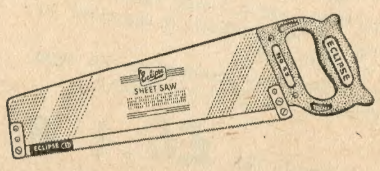

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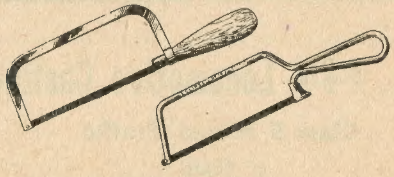

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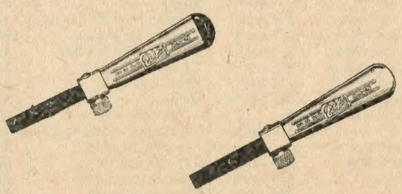

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Model Engineer

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Published every Thursday

Incorporating SHIPS AND SHIP MODELS

IN THIS ISSUE

NEXT WEEK

" Vanessa ": Building a radio-controlled model cabin cruiser

Gramophone pick-up arm: An improved model which avoids some of the shortcomings of commercial arms

Veteran steam fire-engine

Pressure control switch: A device for accurately controlling workshop compressors

Model village: A miniature village that fulfilled an Alice-in-Wonderland dream

All correspondence should be addressed to the Editor, Model Engineer, 19-20, Noel Street, London, W.1.

Smoke Rings

A WEEKLY COMMENTARY BY VULCAN

IN this issue the thirtieth article of Mr Maskelyne's series " Locomotives I have known " is published; it deals with one of the several bogie, singlewheeled designs which, at one time, were so popular on certain English railways.

Writers on locomotive history and development have claimed in the past that the 4-2-2 locomotive, from the purely aesthetic point of view, was the most beautiful of all the hundreds of designs produced. Individual enthusiasts have expressed the opinion that any one of Stirling's for the Great Northern, Johnson's for the Midland, Pollitt's for the Great Central, Dean's for the Great Western, Worsdell's for the North Eastern and even the celebrated No 123 of the Caledonian was " the most beautiful ever."

All these were on common ground in that they were 4-2-2s so there must be some justification for the general opinion. It is a thorny problem which can never be finally settled until a really satisfactory answer can be found to the question: What constitutes beauty in locomotive design?

Elusive point

In each of the above cases the designer was at pains to eliminate, or at least to minimise, anything that would spoil the total effect of the finished design. The degree of success naturally varies, and that is the particular point on which no final agreement seems possible, every enthusiast having his own ideas which must inevitably colour his decision.

But the interesting point is that even today among enthusiasts and students who could never have seen an actual example of a 4-2-2 in her prime, more than 75 per cent. will decide on one of the 4-2-2 designs when asked to give an opinion as to what was the most beautiful locomotive.

On the other hand, there is a minority that will not consider a singlewheeler of any kind.

That clock spring

I MAKE no apology for returning to the question of the pendulum suspension spring for the M.E. Musical Clock. A reader whose only request was that he should be allowed to be anonymous has sent a further supply. I shall be able to send strips of steel to those readers who require them for several more weeks. Please send a stamped addressed envelope with the request.

I received an interesting letter from Mr S. D. Carr, of Fairholme Avenue, Gidea Park, who tells me that his clock is now at the stage where he is concerned with its accuracy at a rate of plus or minus ½ sec. per 24 hr.

Mr Carr removed the clock from its temporary testing bracket to take it to the Romford M.E. Club competition night meeting.

SMOKE RINGS . . .

Dismay at damage

"Although I put it most carefully in a small attache case, I was very dismayed when a sharp-eyed member drew my attention to the fact that one of the escapement wheel teeth had been bent into a hook shape, evidently owing to having received a blow from one of the pallets in transit," he writes.

"On returning home I burned some midnight oil in trying to rectify the damaged tooth, but although I managed to straighten it out without breakage and thought I had got over the trouble, the clock only goes for a few minutes without stopping now and I am afraid it may be quicker and more satisfactory to make another escapement wheel."

Latest news is that Mr Carr had another attempt at correcting the damaged tooth and the clock kept going for two hours. He tells me that with average luck he hopes to have both the striking, chiming and musical parts working within the next few months.

The moral to the sad story of the broken escapement wheel is always to tie up the pendulum crutch before moving the works.

Rigging in the Thames

ONCE more can the lover of the sailing ship see masts and yards towering above the shipping in London's river. *Cutty Sark* has not only had her masts stepped, but since our photograph was taken the yards have been crossed, and soon the delicate tracery of her rigging will be there for all to see.

The restoration of the ship is nearing completion, and everything about her should be in proper seamanlike order when the Queen comes down to Greenwich to open her on June 25.

The new deckhouses are a fine example of the ship carpenter's skill, with their lovely teak panelling; and everything about the ship speaks of the careful research which has been done to show her as she was when she sailed up London river, fresh from her builders' hands, in 1869.

Very few if any of us have ever seen a sailing ship in mint condition, but we will soon have the opportunity. And not only is she an inspiring spectacle, but the museum on her lower deck will be full of sea interest. From the funds it is expected she will raise, she will assist likely youths with a love for the sea to be trained as officers for the Merchant Navy.

Realistic model railway

I HAVE been browsing through a copy of the 1957 edition of the illustrated guide to the Midland Railway Exhibit at the Derby Museum and Art Gallery. The main item of the exhibit is an extensive fine-scale, electrically-operated model railway on which every detail is an exact scale model of its prototype to a scale of 7 mm. to the foot.

The illustrations, reproduced from excellent photographs, clearly indicate the care and skill that have been put into the whole job with a view to achieving a thoroughly realistic effect. Locomotives, rolling stock, signals, station buildings and all the other scenic features are quite convincing; in fact, it is difficult to believe that one or two of the photographs were taken on the model and not at some vantage point somewhere on the old Midland Railway.

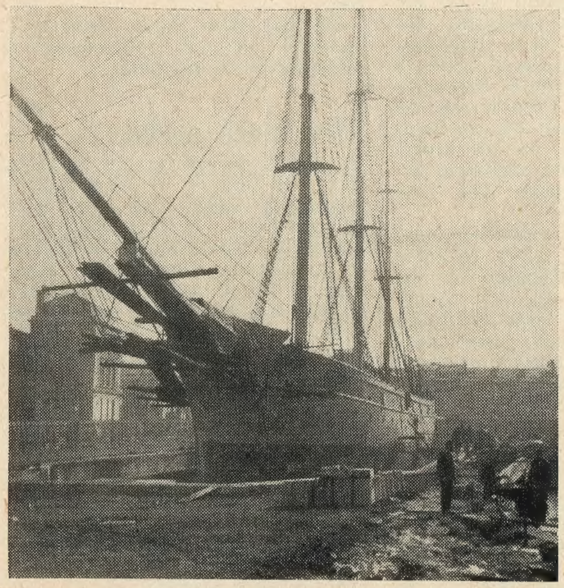
Cover picture

Lewis Lewis holds a model of the bows and foremast of the CUTTY SARK *as he discusses progress of the restoration work with Albert Hyder, Clerk of the Works. The famous clipper can be seen in the background.*

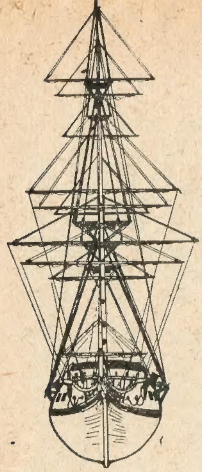
"City of Truro" restored

THE famous G.W.R. engine *City of Truro* has now paid a visit to Swindon Works for a thorough overhaul prior to returning to service. She has been transformed in appearance, since she has been repainted in the 19031 ivery, i.e., the usual green, lined in black and fine orange lines, but with indian red instead of black for the frames.

Since her boiler has top-feed and her chimney a copper cap, she is now in a condition that she never was before ! But it is good to see the old livery again, especially as the tender is now lined out in the old style in three panels with the wonderfully elaborate G.W.R. monogram in the middle panel. The number, which had been 3717 since 1912, has been changed to the original 3440 of 1903.

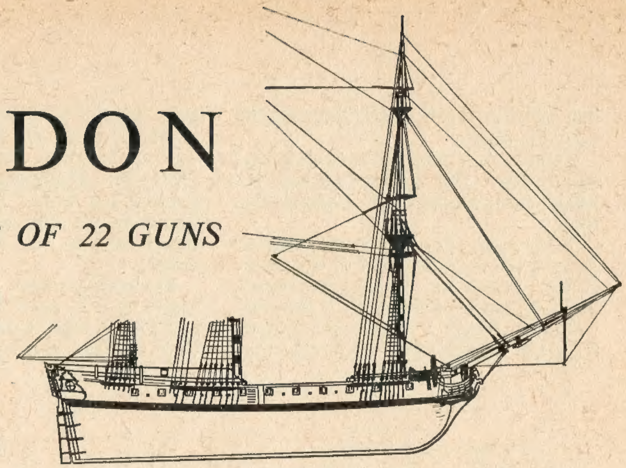


View of CUTTY SARK *on port bow and, right, looking forward from poop gangway*



MYRMIDON

A SHIP-RIGGED SLOOP OF 22 GUNS



Part 4: This week's article by R. J. COLLINS deals with the afterdeck fittings and the erection of the masts

Continued from 7 March 1957, pages 344 to 346

ALONG the after edge of the deck is the fo'c'sle rail (Fig. 46), divided in the middle by the belfry. Each section is 7 ft long with the bottom and top rail 10 in. × 2 in. The lower rail rests on the deck with the top of the upper one 1 ft up. There are three uprights 4 in. square which extend another 9 in. above the rail. Nos 1 and 3 are supported by three knees which are 1 ft 9 in. long on the deck.

The belfry (Fig. 47) is not very large, having an overall height of 3 ft 6 in. The top is 3 ft × 2 ft and the base is 6 in. smaller on both measurements. It will probably be easier to cut the two sides each as one piece complete with base and pillars. These would be 4 in. thick with the pillars square rather than round.

The top can be made from a piece of 6 in. timber from which the convex " cross " is removed with a round file and the upper surface carved to conform. The bell is suspended from a bar across the base. Make the whole thing from " nice " wood and leave natural (varnish), except the top which should be black. Put three ring bolts either side of the mast and one aft of it.

The 18-pounder carronades are made in the same manner as the 24s. The detailed sizes are given on the figure. Fix them forward of the mast where they will fire over the rail.

There are no fittings on the gangway but a ladder leads down to the deck from near the after end. This ladder (Fig. 48) has a slope of 1 ft 9 in. at its widest, the sides not being quite parallel. It is 2 ft 2 in. wide with 2 in. sides and 1½ in. treads 9 in. deep. I cut the sides and mark for the treads with the edge of a three-corner file.

For the treads I cut a strip whose width is the correct length across the grain then part them off from the side. This ensures that each tread is exactly the same length. Touch each end with glue and stand upright on one side, lay the other side in position and then gently close up in the jaws of a vice and leave it to set. I am not decrying the various jigs I have seen but this way serves me very well.

We start the quarterdeck with the rails which are more elaborate than those on the fo'c'sle (Fig. 49). It is 17 ft 9 in. long overall × 3 ft 6 in. high. The six uprights can be turned or square as you wish. I have made them 8 in. thick but make them thinner than this if you can. Start from a full length 1 ft × 2 in. plank on the deck. Six inches above this is another similar length and the pillars are topped by a heavy moulded capping rail 10 in. × 4 in.

I think the best way to make this is to pierce three 2 in. full-length planks, pass the uprights through them and glue another 2 in. plank on to the top. The top two planks could be so cut as to give the moulded effect.

Aft of the rails is the companionway with its steps running athwartship. The deck opening is 5 ft 3 in. × 2 ft 8 in. There is no rail around the top but a low 2 in. coaming. The draught doesn't show, but I would make the ladder go down from starboard to port.

Gratings

Next aft is the reinforcing on the deck beneath the capstan. The top part of this has already been made. There are three more openings in the deck, each covered by gratings, 3 ft 3 in. athwartship and fitting between the beams fore and aft. The coamings are the same as around the companionway.

Aft of the mizen mast is the wheel. The Admiralty draught only shows the supports and the drum. I have added the actual wheel which of course was there. For those who are making the *Atropos* all this can be left out, the steering was done direct from the tiller.

There are several ways of making a wheel but I have found this way the easiest. From some suitable material (I use bone or ivory) turn the drum and the centre boss of the wheel. Drill both pieces for the spindle. Now cut the boss into two, making one much thicker.

Carefully make four radiating saw cuts across the exposed end of the thicker piece. Lay aside for a moment. Turn the rim from a flat piece of material and drill eight equally spaced holes right through inside to out. Turn or otherwise make eight spokes (I use brass wire) and file flat the inner end.

Place the tops in the holes in the rim and lay the flat parts in the saw cuts of the drum. Glue the boss back into position. Eight handles are now turned and inserted into the outer part of the rim. For those who haven't a lathe the drum can be made from a round wooden rod and the rim cut from two pieces of very thin ply with a third piece cut into sections and glued on to one of them. Wooden spokes shaped by twirling against a file and long enough to include the handles are laid in position and the second complete ring glued on.

A single 9 in. block with a 1 ft strop is fastened to an eyebolt in the deck on either side of the drum and another, with a normal strop low down on the bulwarks and level with the first pair. There is another set, also low down but aft of the tiller. Fasten the centre of a line to the drum and wind each end around twice.

Reeve the line through the block on the deck, out to the second on the side, back to the third and then forward to the end of the tiller. If the blocks are smooth and securely fastened the turn of the wheel should pull the tiller from one side to the other. If you wish to show off this feature make sure it is all *very* strong.

Aft of the wheel is another opening, 2 ft 3 in. across × 3 ft 6 in. long. The draught shows the coaming to this as being 9 in. high and it seems possible to me that instead of a grating this had a glass window top. I don't know and don't seem to be able to find out. Either could be right so you

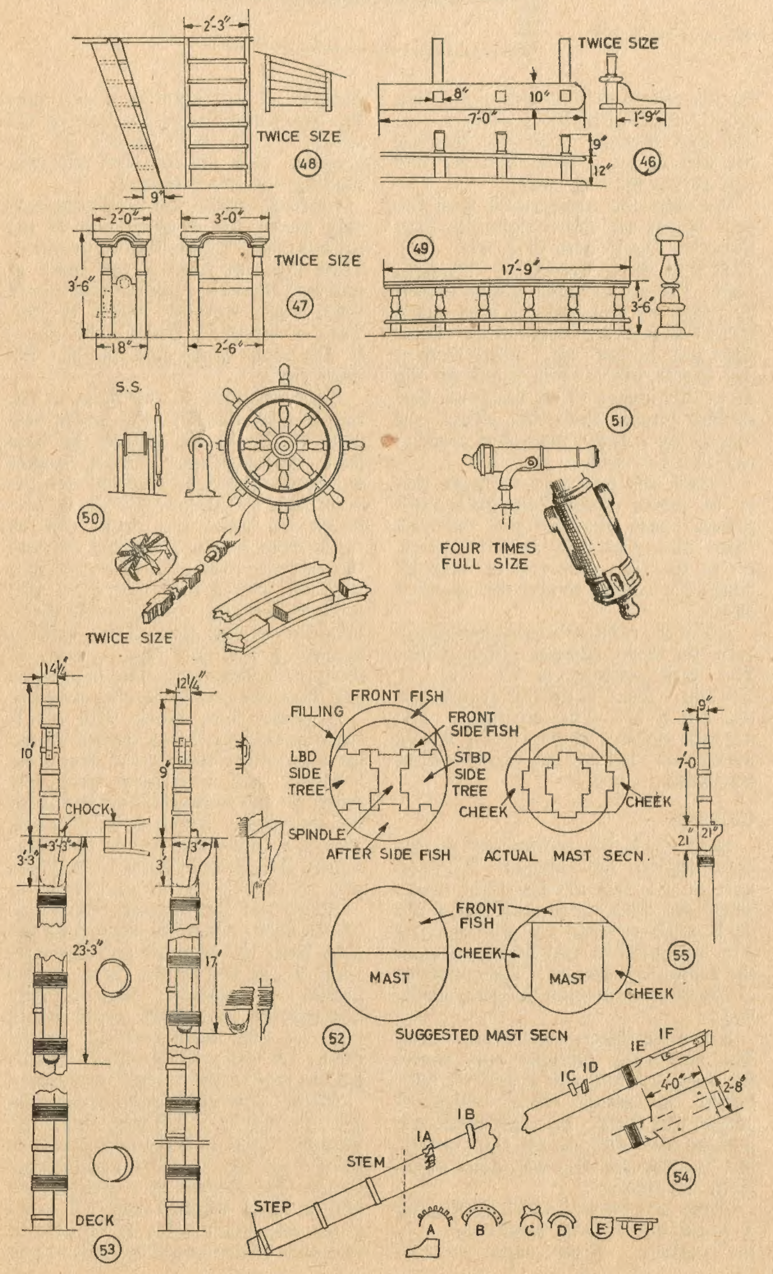
can please yourself. I would personally vote for glass.

Finally aft comes the homing of the rudder top. This is simply a box-like affair with an opening in front for the tiller.

There is an 18-pounder carronade at each of the two gunports of this deck. A small shot rack, holding three balls, could be placed either side of the port.

Almost forgot ! There are timbers for eight swivels but I think that four guns would be enough. In Vol. 5 of *Model Ships and Power Boats* there was an excellent article on guns by John N. Hampton in which he described a swivel from Carisbrook Castle in the Isle of Wight. I went down to see it and this is the result.

My sketch shows a top view. The length is 2 ft, bore 2 in., muzzle 4 in. and breech 6 in. I don't know if there were straight Y-pieces but the sketch shows an actual one so it must be safe to copy it (Fig. 51).



If you have not packed away the parts you have completed I suggest you do so because the masts and yards, to be made correctly, will take quite a time. My usual remarks that masts are not just rounded and tapered lengths of wood are even more justified now.

I know this is your model and if you wish to put in a couple of dowels there is nothing to prevent you. But please don't skimp them. They are as much part of the model as the deck or keel. I give a few sketches (Fig. 52) from Steele to show you how they were made and add some suggestions of my own. The chief thing is to make them look correct because after all, you are not making a "solid" blue-print but a three-dimensional picture in which the representation of the finished subject is the aim.

Select some suitable wood, and by "suitable" I mean wood with a straight but not too obvious grain. I think that lance wood (or its more common substitute, dugame wood) is just the best you can get. Some dealers in furniture wood, veneer importers or the like may stock it as it is sometimes used for very special dowels, among other things. The ordinary timber merchant may not even have heard of it.

Larboard and port

Dealing with the fore and main first, the mast is more or less round to some distance from the top where it becomes square. This square part is called the head. Extra pieces are fastened on to the main part, that in front, for all the rounded length, is called the "front fish" and fared into the side of the mast by pieces called "fillings."

About the upper third of the round part are pieces on the sides as well. These are called "cheeks," larboard or starboard as the case may be. The word port had not been invented at this time. Just below the mast-head the cheeks altered their shape and became the "hounds," the projecting bracket-like part being known as the "bibb."

I suggest that instead of cutting the various pieces to fit the shape of the mast the actual contacting surfaces be planed flat, the metal woolding rings be put on and the pieces fastened on top of them. If these rings are of metal the joints can be concealed under the front fish.

You could make them of gummed paper but metal would be best; but whatever you use, paint them first as it is so difficult to paint the edges after they are on. The rope wooldings go over the lot and the wooden

protection rings above and below can well be made of brown paper and left natural colour, the whole mast and fittings being varnished when completed (Fig. 53).

The bibbs are let into the front of the cheeks and open out a little as they leave their seating.

The head also has a number of metal bands, and note that the sharp corners have been removed. In fact there must be no sharp corners anywhere which might come into contact with ropes. On the larger ships, as an additional safeguard, wooden battens are fixed on near the corners, but I have not included them here.

Among the fittings on the masthead is the heavy cleat which holds the strops of the jeer blocks, and a chock, near the trestle trees, to steady the heel of the top mast.

The bowsprit is much more simply made, at least for the smaller ships. Here it is presumed to be made from one tree and is round in section until nearly the outer end. The actual heel is squared off to fit the step and between this and the ship's stem there should be two or three bands of metal woolding.

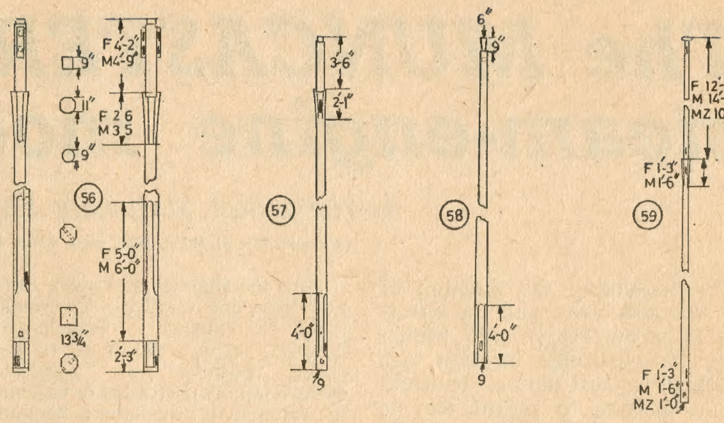
As we pass towards the peak there comes the stop cleats for the gammoning, a saddle fairlead for the running rigging, another saddle for the jib boom and a different sort of saddle for the slings of the sprityard. Then a band of rope woolding with protection rings and the bowsprit shapes off to take the "bee's seat" and bee blocks and finally the cap (Fig. 54).

The mizen mast is also free from wooldings except a couple of metal ones near the squared heel and a rope one beneath the simplified hounds (Fig. 55).

Curved taper

The masts taper, not straight, but as an arc of a circle, and to show this Steele gives the various dimensions at the quarters. They are as follows: the partners (in this case the main deck) is the given size; the round at the heel is 6/7; the first quarter above the partners 60/61; second 14/15; third 6/7; at the hounds $\frac{3}{4}$; and the top of the head 2/3; for the mizen mast the top of the head is $\frac{7}{8}$; the bowsprit similar until the second quarter which is 11/12; third 4/5 and the outer end 5/9. These sizes are of course for the mast itself and do not include fish or cheeks.

Sizes: bowsprit from stem 36 ft, thickness 22 in.; foremast 56 ft 6 in. from main deck, thickness 19 in.; length of cheek and hounds 17 ft; masthead 9 ft; mainmast 62 ft 6 in. from the deck, thickness $21\frac{7}{8}$ in.; length of cheek and hounds 23 ft 3 in.; masthead 10 ft; mizen mast 51 ft from the deck, thickness 14 in.; masthead 7 ft. More detailed measurements are given on the figures.



The topmasts are of more straightforward construction, inasmuch as they were generally made from one tree. It starts off at the heel with a short eight-sided section in which was cut the sheave hole for the lower top rope. Next a square section called the heeling through which ran the fid hole, then another octagonal section with the upper top-rope sheave hole near its base.

When stepped the octagonal part finishes just below the cap. The given thickness of the topmast was where it passes through the cap so allow a little more when you start cutting out the rough to take in the heeling. The taper is a straight one but does not reach all the way. Working back from the top is the square-sectioned head and then a wider eight-sided length (the hounds) which merges into the round of the rest of the mast.

The fractions given by Steele are as follow: counting the part of the mast which goes through the cap as zero the first quarter is 60/61, second 11/15, third 5/7 and below the hounds 13/16, flaring out to 9/10 at the top of them. The base of the head is 9/13 and the top 6/11. There are a couple of cheek blocks either side of the head and the extreme top is made a few inches smaller for the cap (Fig. 56). The mizen mast has no cheek blocks but a sheave hole for the topsail tie passes fore and aft through the hounds (Fig. 57).

Here are the actual measurements to the nearest half inch: fore topmast 38 ft 4 in. long, breadth 1 ft 1 in.; hounds 2 ft 6 in. and head 4 ft 2 in.; main topmast 43 ft 2 in. long, breadth 1 ft 1 in.; hounds 3 ft 5 in. and head 4 ft 9 in.; mizen topmast 32 ft 5 in. long, breadth 9 in.; hounds 2 ft 1 in. and head 3 ft 6 in.

The jib boom is even simpler. The heel is octagonal and has a lateral sheave hole through it. The spar tapers evenly throughout its entire length, the outer point being 2/3 of its given thickness. There is a longitudinal sheave hole near the end which is shaped to provide a stopper for some of the rigging. Length overall is 31 ft, breadth 9 in. (Fig. 58).

Topgallant masts. Here is another of those subjects which is not treated clearly in the old books. The list gives royal yards but definitely no royal masts. There are pictures of topgallant masts elongated into royals so I have had to work out their probable sizes and give them as that.

The heel has a short square section which leads directly into the round without any intervening octagonal length as with the lower masts. Just above the square is the top-rope sheave hole cut through at an angle. The mast tapers to the hounds just as did the topmasts and there is a sheave hole for the topgallant tie through the hounds.

Above this is the royal mast starting at $\frac{3}{4}$ of the topgallant and tapering to 2/3 at the top which finishes with a truck. A sheave hole for the royal halyard is cut fore and aft just below the top. Sizes: fore topgallant 19 ft 2 in., breadth $6\frac{1}{2}$ in., heel 1 ft 3 in., hounds 1 ft 3 in., royal 12 ft 4 in.; main topgallant 21 ft 7 in., breadth $7\frac{1}{2}$ in., heel 1 ft 6 in., hounds 1 ft 6 in., royal 21 ft 7 in.; mizen topgallant 16 ft, breadth $5\frac{1}{2}$ in., heel 1 ft, hounds 1 ft, royal 10 ft (Fig. 59).

● *To be continued*

FOR THE BEGINNER

The Scottie Book of Model Railways, by Gerald Pollinger, published by Transworld, price 2s. 6d., is intended for those with their first train set. It gives the answer to many of the questions asked by such beginners and fills a useful niche.

The MUNCASTER steam-engine models

By Edgar T. Westbury

4—Horizontal Stationary Engines

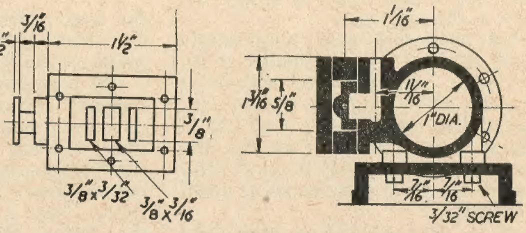
Continued from 21 March 1957, pages 420 to 422

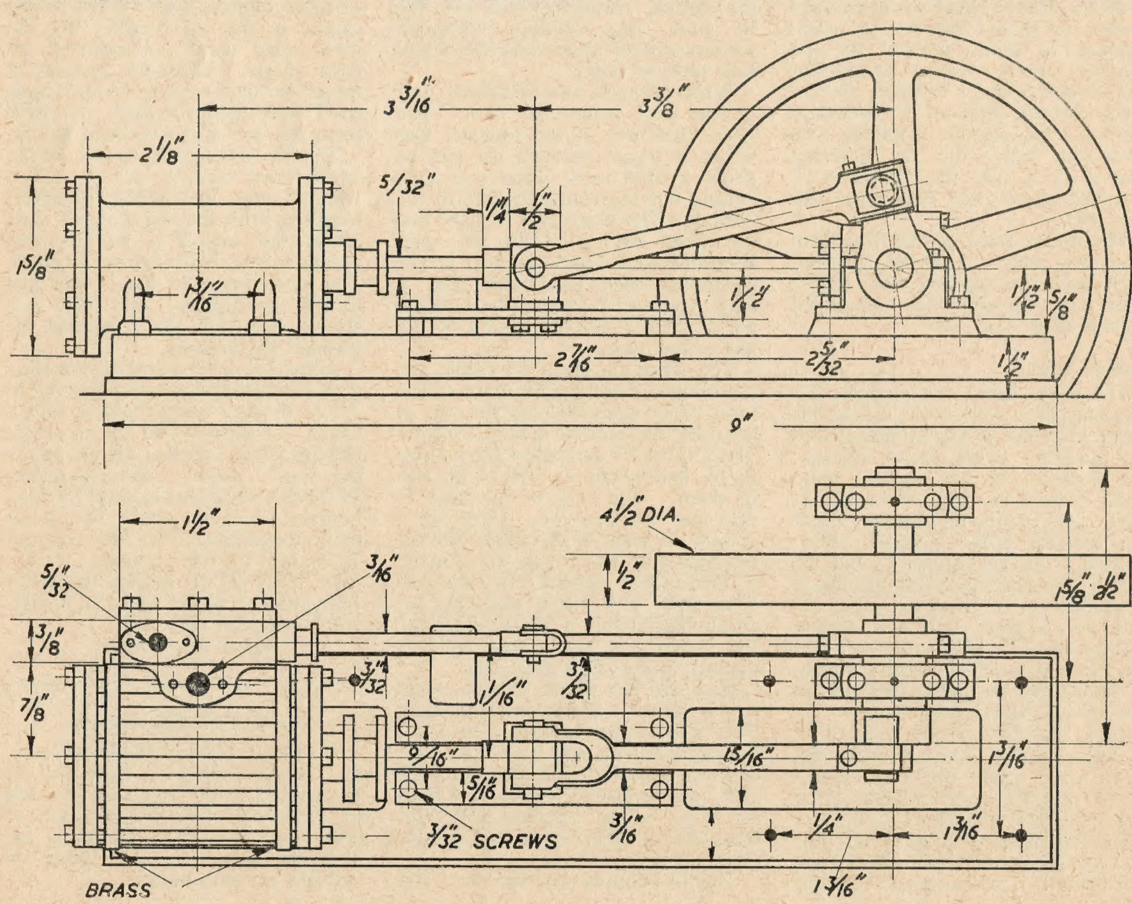
IN DESCRIBING the function of the slide-valve and the effects of lap and lead [Fig. 17, March 12], no particular mention was made of exhaust timing. It would be a mistake to regard this as insignificant, but it is generally satisfactory to allow it to keep in phase with the steam admission, as it must inevitably do so in a simple slide-valve, and it is usual to make the inside edges, in other words the width of the valve cavity, such that they just, and only just, span the inside edges of the cylinder ports at mid travel (right-hand diagram).

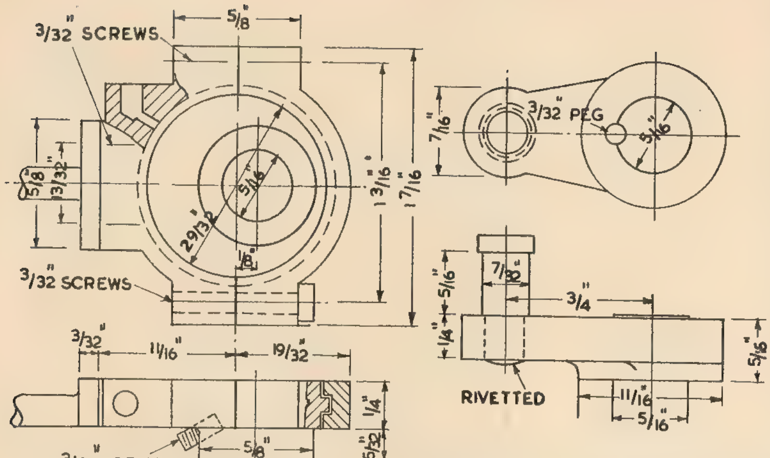
Thus the slightest movement either way opens one or other of the cylinder ports to exhaust. Occasionally, however, engines are timed to give either "positive" or "negative" exhaust lap, by narrowing or widening the valve cavity; the latter is the more common and its object is usually to avoid excessive "cushioning" or compression, or to eliminate risk of back pressure in the exhaust system.

The conventional stationary or so-called "mill" engine forms an excellent exercise in steam-engine construction, and is deservedly popular. Several examples of these engines were

Right, Fig. 20: A cross section of steam-chest and a portface, showing the port dimensions Below, Fig. 19: A horizontal mill engine, 1 in. bore × 1 in. stroke, with bar crosshead slides







Above, Fig. 23: Details of the crank and eccentric

designed by Muncaster, all generally similar in major features but differing in size and certain details. The first, shown in Fig. 18 [March 21], is scaled down from a fairly large engine, 12 in. bore × 18 in. stroke, in the proportion of 1 in. to 1 ft.

No dimensions are given on the actual drawing, but Muncaster gives a table of dimensions worked out to exact scale. I have taken the liberty of modifying some of these to give round fractional figures, as most constructors would undoubtedly wish to use standard drills, reamers and stock materials wherever possible; but general proportions have been closely adhered to.

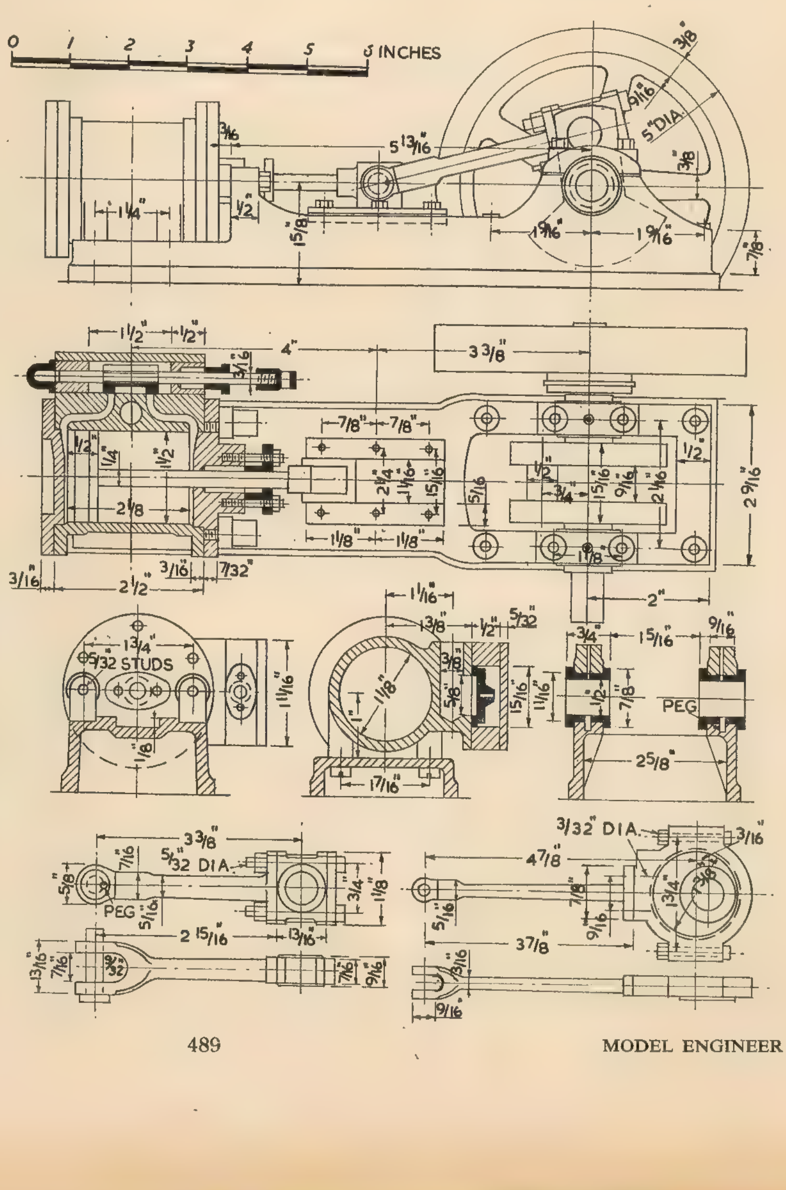
The cylinder dimensions for the 1 in. scale model are 1 in. bore × $1\frac{1}{2}$ in. stroke. Piston rod diameter $\frac{3}{16}$ in., crosshead $\frac{1}{4}$ in. wide inside fork, with crosshead pin $\frac{3}{16}$ in. dia. Connecting rod, circular section, fish-bellied, $\frac{3}{16}$ in. dia. at the two ends, swelling to $\frac{1}{4}$ in. centre; length between bearing centres $2\frac{5}{8}$ in. Crankshaft $\frac{7}{16}$ in. dia., with journals reduced to $\frac{3}{8}$ in. × $\frac{1}{2}$ in. bearing length; crankpin $\frac{1}{4}$ in. dia. × $\frac{5}{16}$ in. long. Flywheel 5 in. dia. with rim section $\frac{1}{2}$ in. square. Eccentric throw 7/64 in., rod circular section, tapered from $\frac{1}{8}$ in. to 7/64 in. Valve spindle 7/64 in. dia., valve travel 7/32 in. Port dimensions: steam-ports 5/64 in. × $\frac{7}{16}$ in., exhaust 5/32 in. wide. Valve travel 7/32 in., lap 3/64 in., cavity $\frac{5}{16}$ in., lead 1/100 in. Steam inlet $\frac{1}{4}$ in. dia., exhaust outlet $\frac{5}{16}$ in.

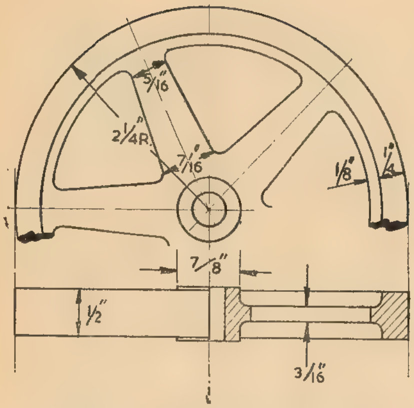
As the constructional methods for this and the second engine are generally similar, they may be considered together. In the latter case, illustrated in Fig. 19, leading dimensions are given on the drawing. Both engines are intended to be built from castings, though fabrication of most of the components is practicable.

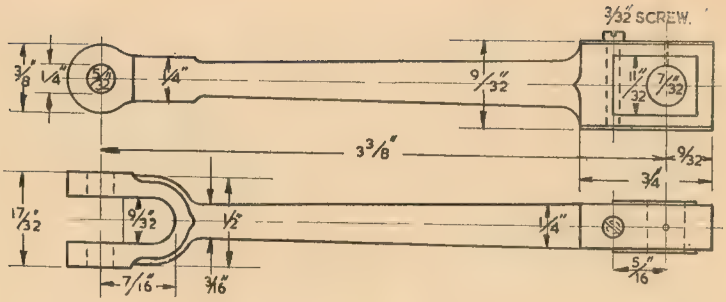
The main components are mounted on a long box-section bedplate, with machined facings where required, and it is desirable to machine these in order to ensure accurate location and secure mounting of the parts, but in the absence of proper facilities they may be filed and scraped, accuracy being checked by means of a surface plate.

It will be seen that both engines have an outboard crankshaft bearing, or "pillow block," which must be accurately lined up with the other bearing mounted on the bedplate; for this reason the actual foundation on which the latter is mounted must also be flat and true. It may be made from a thick slab of well-seasoned hardwood, with a cavity cut out to clear the flywheel.

Below, Fig. 24: A horizontal engine, $1\frac{1}{2}$ in. bore × $1\frac{1}{2}$ in. stroke, with a slipper crosshead







Left, Fig. 21: Details of the flywheel. Above, Fig. 22: Details of the connecting rod. Below, Fig. 25: An engine of similar dimensions with trunk crosshead

Many constructors, no doubt, would prefer to make the engine self-contained by extending the cast bedplate to carry the outboard bearing; I have designed most of my engines to avoid the need for extraneous parts which have to be lined up. A single bedplate with facings for all essential parts, machined off to the same level throughout, greatly facilitates accurate construction.

The cylinders of both engines are bolted down to the bedplate, being provided with cast feet or flanged brackets, and the bearings, which are of the split plummer block type, are similarly fixed. Details of the steam-chest, flywheel, connecting rod, crank and eccentric sheave, with its strap, are given in Figs 20 to 23.

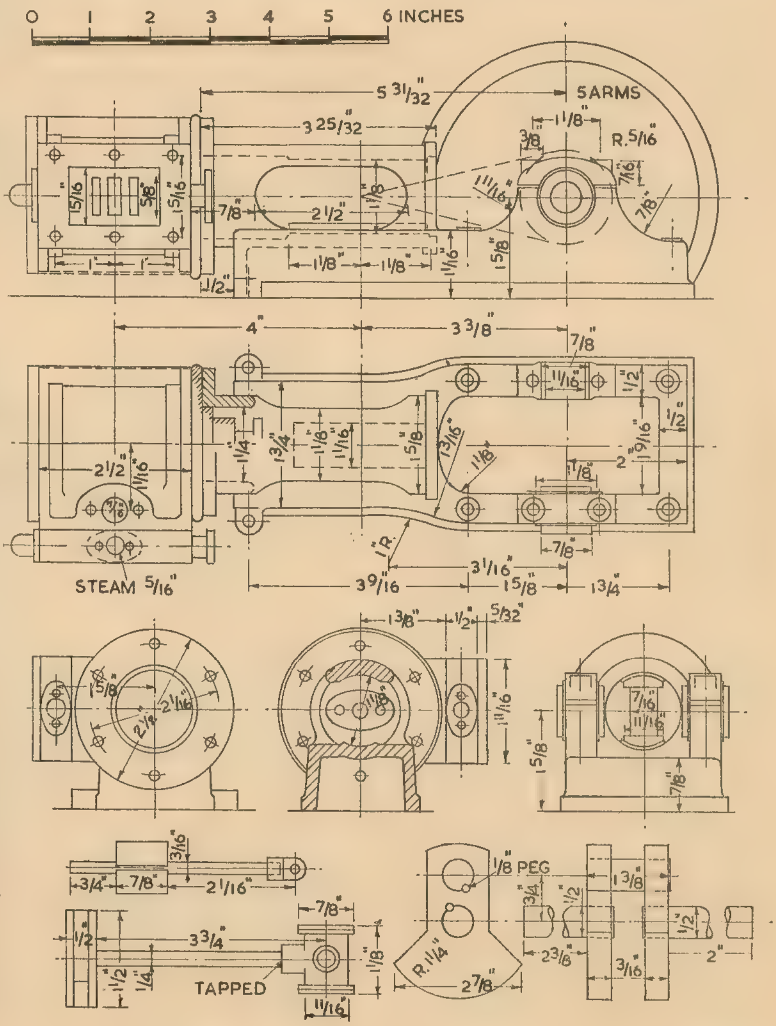
The main difference in the two engines is in the type of crosshead employed; the first example has die blocks fitted to the extended ends of the crosshead pins and working between girder-shaped guide bars mounted on pillars fixed to the bedplate, while the other has a slipper type crosshead working on single guide bars each side. Both types are well established in full-size practice; they require very careful lining up in respect of height and parallelism with the cylinder axis to ensure smooth movement of the piston rod.

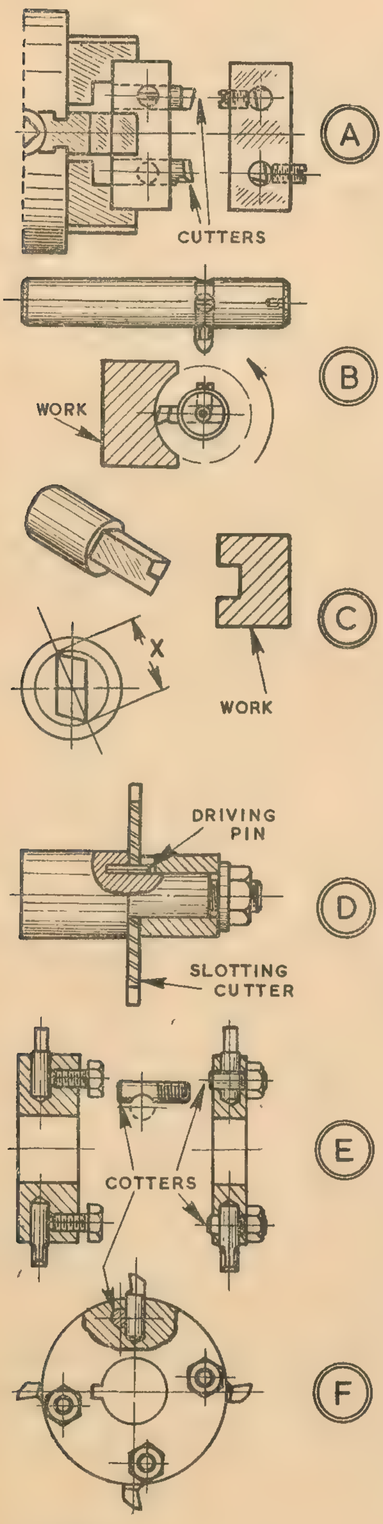
In this respect they may possibly be more difficult to fit than the trunk type of crosshead, in which alignment is automatic if machining is properly carried out; on the other hand, they are sometimes preferred because they offer facility of adjustment to compensate wear or initial errors.

The crosshead of the first engine is forked to admit the little-end eye of the connecting rod, but in the second arrangement matters are reversed by forking the end of the rod to span the slipper crosshead block. This type of rod may be a little more difficult to shape than the previous type, but it looks very nice when properly carried out and I have given instructions on how to produce forked rods from the solid in articles on the Unicorn mill engine.

Muncaster suggests forging parts of this nature, which is very sound advice—or at least it was in his time, when nearly all fitters had some knowledge of smith's work; but this seems to be practically a lost art nowadays. There are, however, many

● *Continued on page 515*





BEGINNER'S WORKSHOP

SIMPLE MILLING CUTTERS

By Geometer

FOR a large number of milling operations, as performed by the amateur in the lathe when rate of production is not important, simple cutters contrived at very small cost in the workshop provide results equal to those obtaining from bought tools.

It is not, of course, essential to employ multi-tooth or multi-blade cutters for many milling and similar operations. With care, and by regulating the speed and feed, the same work can often be done with a single-point tool. In production work, multi-cutting-edges permit of a high rate of feed; and wear is distributed over all the cutting edges—which together mean faster production and longer runs on set-ups.

For facing operations in production work, a large end mill or slab face cutter would be used; but in lathe milling, a single-point cutter or tool as used for turning can be employed. If the surface is small, a tool off-set in the independent chuck is all that is required; and such a tool will also cut a slot.

If the surface is large, however, a holder is necessary for the tool, this being mounted in the independent chuck. In such an event, an improved double-blade cutter can be made, as at *A*, where a piece of rectangular mild steel has been drilled (and, if possible, reamed) to take two round tools held by grubscrews.

True setting in the chuck with the cutter tips rotating in the same plane can be easily checked by allowing the tips to scrape past a fixed bar on the slide or other mounting. Should the setting be incorrect, the holder can then be tapped or packed as required; and the cutters can be adjusted by the chuck jaws to spin on the same circle. A preliminary check for projection of the cutters from the holder can be made by laying this on its back on a surface plate, and using a surface gauge or height gauge, over the cutter tips.

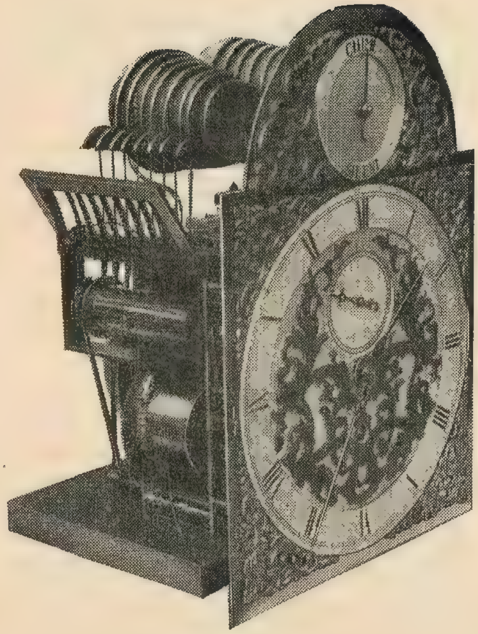
For milling soft materials like aluminium or brass, cutters of silver steel, hardened and tempered, are satisfactory; but for cast iron and steel, cutters can be made from short pieces of round high-speed or alloy steel tools.

For milling hollow surfaces or radii, a single-point tool set in a mandrel can be used, as at *B*. The mandrel should be driven by holding one end in the chuck and supporting the other at the tailstock, since a set-up between centres driving the mandrel by a carrier is too choppy and chatter-inducing. A double-edged cutter can be used on this set-up, checked for length over its tips and set centrally in the mandrel.

Small end cutters for narrow slots in work can be made from silver steel, as at *C*. The piece of rod should be turned to the diameter, *X*, of the cutter. Then the diameter is filed to rectangular section, backed off behind the cutting sides; and the end face is backed off oppositely to form a pair of cutting edges. The tool is hardened and tempered in the normal way and should be run at fairly high speed with light cuts.

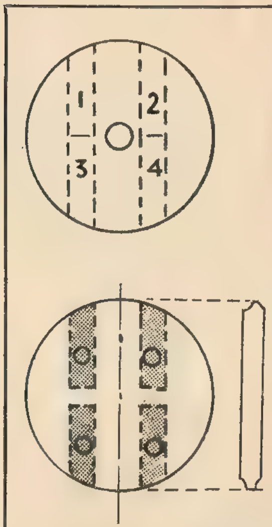
A bought slotting cutter or saw needs to be mounted on a mandrel, as at *D*, where there is a driving pin fitting in the keyway, and the sleeve holding the cutter up to the shoulder is slotted to fit over the driving pin.

As distinct from saws, slotting cutters may be built up in a mild-steel holder, as at *E* and *F*. Four or more cutters or tools may be used, clamped by grubscrews or setscrews, the tools being flattened on the sides if required. Grooved cotters, however, admit of a narrower holder and avoid the need for tapped holes. The holes for the cutters having been drilled, they should be temporarily plugged (pieces left projecting for removal), then the cotter holes can be easily drilled through the holder. ■



The M. E. MUSICAL CLOCK

S. W. CARR solves some of your gear-cutting problems in this article on the making of the fly-cutters



The author's suggestion for the cutting of the fly-cutter blanks

THE TOOTH FORM for clock gears is neither involute nor cycloidal, but an approximation to the cycloidal form known as ogival, the ogive being the shape of the Gothic arch, which is formed by drawing a radius equal to the width of the opening from each side.

There are variations such as "two-thirds ogive" and "half-round" which I won't bother with.

The depth of the tooth is considerably more than usually given by the formula $\frac{1.57}{\text{d.p.}}$ and this means that the blank has to be larger in diameter than with either of the usual tooth forms (given by $\frac{\text{No of teeth} + 2}{\text{d.p.}}$) and is increased to $\frac{\text{No of teeth} + 2.7}{\text{d.p.}}$

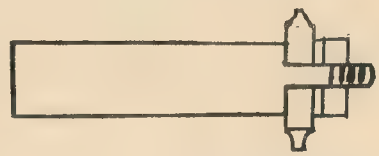
The sides of the teeth are straight radial lines (which would all meet in a point at the centre of the gear) from the bottom up to the pitch line, and from there they take the ogive curve whose radius is equal to the width of the tooth at the pitch line (also the width of the spaces).

The two ogive curves meet in a fairly sharp point and this indicates when the correct depth has been cut.

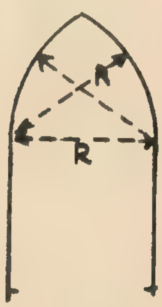
In the case of gears with large numbers of teeth the sides are so nearly parallel that the slight taper can be ignored, but below about 40 teeth the taper becomes rather more important.

The angle included between the two sides of a tooth (or space) is simply $\frac{360 \text{ deg.}}{\text{twice No of teeth}}$ or $\frac{180 \text{ deg.,}}{\text{No of teeth}}$ so for a 60 t. wheel the sides of the teeth and spaces include an angle of $\frac{180}{60} =$ 3 deg., or about 51 thou. per inch of length.

As few of the gears required for this job exceed 0.050 in. depth it will be seen that the actual amount of



Method of mounting cutter in the arbor or mandrel



Principle of the Gothic arch-form

Right: Gear-wheel teeth in the full ogive shape

(*a*) *addendum* $= \frac{1.35}{d.p.}$

(*b*) *dedendum* $= \frac{1.55}{d.p.}$

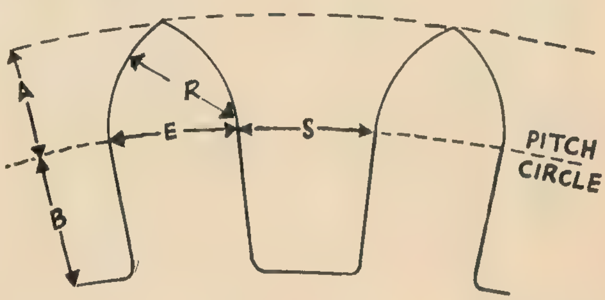
(*e*) *tooth width* $= \frac{1.57}{d.p.}$

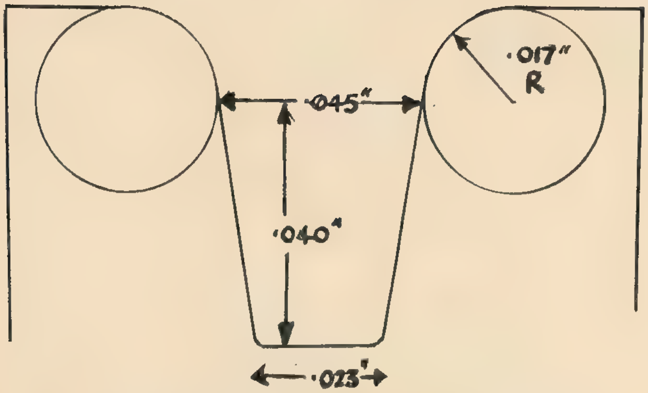
(*r*) *radius* $= \frac{1.57}{d.p.}$

(*s*) *space width* $= \frac{1.57}{d.p.}$

Diameter of blank $= \frac{No\ of\ teeth + 2.7}{d.p.}$

Included angle of radial flanks $= \frac{180\ deg.}{No\ of\ teeth}$





Form tool for making fly-cutter for eight-tooth 44 *d.p. pinion*

taper in the tooth is about 0.001 in.

When we come down to six teeth, however, it is rather different for the angle becomes $\frac{180}{6}$ or 30 deg., and this cannot be ignored.

It is usual in the case of small pinions like this to reduce the amount of tooth projecting beyond the pitch line (the addendum) by making it semi-circular or half-round in shape, as this reduces interference; also the width of the pinion tooth is a good deal less than the space between, the figures for tooth width being $\frac{1.15}{\text{d.p.}}$ and the space $\frac{1.99}{\text{d.p.}}$

The half-round tooth top is used above eight teeth but apparently a one-third ogive will suit all numbers of teeth, so I have given sizes for this pattern.

Working to these sizes should enable anyone to make fly-cutters to cut quite accurate gears giving the minimum of friction, using the method described by Mr Stevens, but he used an already cut gear for the pattern and this might not always be available.

I made my 96 t. hour wheel too small through an error in setting the trepanning cutter which I used to make the blank from sheet brass, and when I came to fit up the motion work I could not get the minute wheel pinion into engagement with it; so I made up a fly-cutter and this did the cutting splendidly in one pass with a high speed and slow feed.

I cut the form on to a circular blank of gauge plate and cut sections out of this to make the actual cutters. One blank will make at least four good cutters and my experience is that while you have a few spares you rarely have any breakages—it's always that last one which lets you down.

Doing this gave me another idea which avoids any possible error in setting cutters up square. Instead of making the blank with a centre hole and then cutting out the dotted pieces to make the four fly-cutters, I propose making the blank with four holes as shown in the diagram. These can be used to screw the blank to a wood chuck when turning the form. (It is much easier to turn a complete circle than to use the hit and miss cut used by Mr. Stevens.)

After turning, the parts indicated by dotted lines are cut out and hardened and you have a hole to mount the cutter nice and square.

By making the cutters short you can use a very high r.p.m. without involving a high surface speed, and this gives the same cutting action as if using a proper circular multi-tooth cutter.

I find that if hardened in cold water and tempered to the lightest of straw colours these cutters show no deterioration in use which could be detected in a 96 t. wheel.

I attach a table which I think is correct to the nearest thou. The basis of the calculations is taken from *Gears for Small Mechanisms* by W. O. Davis, and the following diagram will show the standard proportions of wheel and pinion teeth.

I have given the sizes of the *spaces* in the tables, which is of course what you require for the fly-cutter. ■

Sizes for fly-cutters for d.p.s required for M.E. clock. Sizes are in decimals of one inch

PINIONS

D.P.	34	40	42	44	48	52
a	0.022	0.019	0.018	0.017	0.016	0.014
b	0.052	0.044	0.042	0.040	0.037	0.034
S	0.059	0.050	0 048	0.045	0.042	0.038
R	0.023	0.019	0.018	0.017	0.016	0.015

WHEELS

D.P.	34	40	42	44	48	52
A	0.040	0.034	0.032	0.031	0.028	0.026
B	0.045	0.039	0.037	0.035	0.032	0.030
S	0.046	0.039	0.038	0.036	0.033	0.030
R	0.046	0.039	0.038	0.036	0.033	0.030

Below: Pinion teeth, shaped one-third ogive

(*a*) *addendum* $= \frac{0.74}{d.p.}$

(*b*) *dedendum* $= \frac{1.75}{d.p.}$

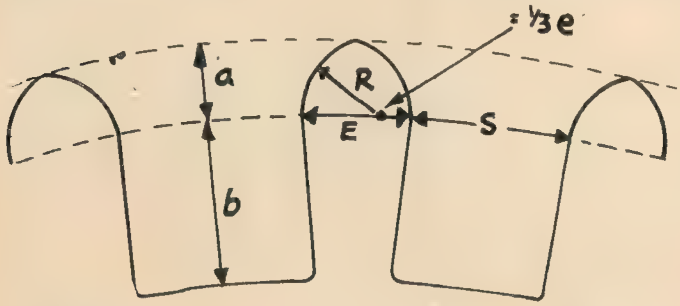
(*e*) *tooth width* $= \frac{1.15}{d.p.}$

(*r*) *radius* $= \frac{0.77}{d.p.}$

(*s*) *space width* $= \frac{1.99}{d.p.}$

diameter of blank $= \frac{\textit{No of teeth} + 1.48}{d.p.}$

included angle of radial sides $= \frac{180\ deg.}{\textit{No of teeth}}$



Ship modelling for beginners

Continuing his discussion on the simpler methods of building model hulls QUAYSIDER now gives his attention to the possibilities of the planked hull

PERHAPS the easiest of all forms of model boat hulls to construct is the hard chine hull, briefly mentioned at the conclusion of the previous article in this series in the issue for March 7. This is the type usually favoured by the beginner, and it has the widest possible application in making simple models.

This type can be considered as the planked hull in its simplest form, as in essence it consists of adding a skin to a frame. All that is needed for a small hull is a number of strips of wood $\frac{1}{8}$ in. or $\frac{3}{16}$ in. square to form the keel, the chines, and the gunwales, a flat piece of wood about $\frac{3}{16}$ in. thick for the transom, and some thin three-ply for the skin. The keel will have a short additional piece for the stem fixed on with screws and glue. The sketch (Fig. 14) will make this clear.

After the transom is shaped, the strips should be pinned and glued in the notches in the corners and bent around a temporary bulkhead—shown dotted in the sketch—to give the shape of the hull, and then fixed to the stem by means of tiny screws and glue. The skin is pinned and glued in position, first the sides and then the floors.

The curved V-formation at the stem, shown in Figs 6 and 7 in the issue for February 7, can be ignored in a simple hull. These drawings show also the general form of this type of hull, although actually there is no limit to the variations possible.

When the glue has set the bulkhead can be removed and two or three beams put in at suitable places to retain the shape. A deck can now be fitted, cut away to suit the hood or cabin which protects the engine. The engine should be mounted on longitudinal bearers fitted to the floors on each side of the keel. The keel will need to be reinforced on each side where it is cut away to take the propeller shaft, unless it has been made wider in the first place to allow for this.

THE PLANK ON FRAME HULL

The usual reaction of the beginner in ship modelling to the suggestion that he should build a planked hull is that it is much too difficult, and is in fact a method only for the advanced worker. Admittedly the purist's method of building up the keel and stem in detail, carving or steaming the frames, fitting deck beams and finishing sides and decks with scale planking is far beyond the skill of the beginner.

There are, however, simpler methods, especially in these days of resin-bonded ply-woods and modern adhesives which are impervious to moisture and the beginner would be well advised to give them serious consideration. After one or two preliminary exercises in hull construction by other methods, he would find a planked hull a quite straightforward job.

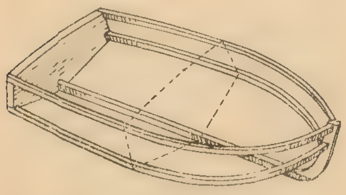
The big advantage of the system is that it produces a very light hull, is economical in material, and at every stage of the construction the model looks like a ship and is a delight to the eye. I have heard several people say that, after building a planked hull, they would never consider any other method. It was easier than they thought and much more interesting.

Let us, therefore, make a start with a simple sailing model. I strongly recommend the beginner to build a sailing model as he will learn more about a ship by sailing his model than he could by any other way. Even King Solomon found "the way of a ship in the sea" one of life's most intriguing problems, and man still finds it to be so.

The yachtsman, whether he sails full-size or model yachts, could vouch for the truth of this. The fascination of sailing a ship or a model never fades and in my opinion the man who sails his models gets much more out of his hobby than the man who builds only for exhibition. In addition to his handicraft he has a healthy sport that will keep him mentally and physically alert to an advanced age.

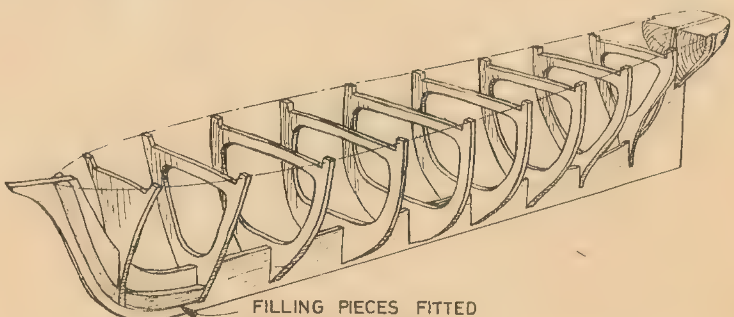
To get back to our planked model—a suitable size for a first attempt would be about 30 in. long. This may look rather long on the drawing board and when the model is being made on the bench or on the kitchen table; but once it is on the water it will look surprisingly small.

I know a man who, when considering this same question, hit on the scheme of throwing a piece of wood of a given length into the water to see what it looked like for size when it was some little distance from the bank. He got quite a shock when he saw how much even a little distance diminished the apparent size, and he tried larger and still larger pieces of



Above, Fig. 14: *The framework for a hard chine hull*

Right, Fig. 15: *The framing for a simple planked hull*



wood until he finished up by building a model 8 ft long !

I propose we build a hull of the type common amongst the wooden sailing coasters of from 50 to 100 years ago. There is a great variety of rigs suitable for such a hull, and I think any of them would be more interesting to sail than the modern Bermudian-rigged sloop.

Speed under sail is quite another matter; I presume what we are aiming at is to learn how to handle a boat under sail. We could rig our hull as a gaff cutter, as a ketch, as a fore-and-aft schooner, as a topsail schooner or even as a brig (see Fig. 16). In fact the rig could be changed from time to time, and experiments made concerning the effects of the various rigs, and as they were carried out on the same hull the results would be a true comparison and would have real value.

Another interesting possibility would be for a school or a youth club to build a number of hulls to the one design and to equip them with various rigs. They could then be tried out one against the other and if it were found that one particular rig was always superior to the others, and it was suspected that its success was due to the skill of the skipper—as it often is—another skipper could sail it and thus a truer appreciation of the merits of the rig would be possible.

Such a scheme is worthy of serious consideration by youth club leaders and teachers of craftsmanship in schools.

The simplest method of hull construction for a planked model is shown in Fig. 15. The keel is cut out of five-ply about $\frac{1}{4}$ in. thick making the stem and sternpost in one piece with it. Slots are then cut out $2\frac{1}{2}$ in. to 3 in. apart to receive the frames. These are cut out as shown, making both sides in one and including the deck beam with it. The ends are continued above the deckbeams to form stanchions for the bulwarks. The frames are slotted on the centre-line to fit on the keel, egg-box fashion.

Avoiding complications

If the slots are cut true and made a tight fit, the frames will be held firmly and squarely on the keel. To avoid the rather complicated curves at the stern the counter should be shaped from two blocks fixed on each side of the central web. They are provided with rebates to receive the ends of the planks. Filling pieces should be fixed between the frames on each side and shaped to form a convenient platform to which the first pair of planks, known as the garboard strakes, will be fixed.

The planks should be prepared in suitable lengths from straight-grained mahogany, cedar or even good quality pine about $\frac{1}{2}$ in. wide and 3/32 in. to $\frac{1}{8}$ in. thick. These should be fitted in pairs, one on each side, working upward from the garboard strake until the top of the bulwarks is reached. The full width of the planks will be required amidships, from which point it tapers toward each end.

The number of planks required can be found by marking off the width of the strip on the midship section. The depth at the stem and stern can be divided into this number of spaces which will give the width of the planks at the ends. The taper of the planks should be equal and smooth so that the lines flow symmetrically. In a hull of this type the lines flow smoothly with about the same amount of taper at each end, so the planks will bend easily into position.

If necessary they may be steamed or soaked in hot water, or even just heated for a little while, after which they can be bent to the right shape by manipulation between finger and thumb. They can then be fitted in the required position without any strain.

Using a small plane fit them closely along the edges and before finally pinning them down glue should be run along the edges and where they touch the frames. They are secured at each end by tiny brass screws and at each frame by small panel pins or entymological pins. When using screws it is important to drill and countersink the planks first to avoid splitting.

Laying the deck

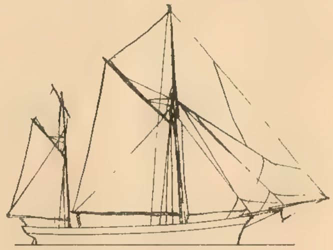
The deck is made of sycamore or similar close-grained wood $\frac{1}{16}$ in. thick, or thin three-ply could be used if preferred. In order to get it easily into position it should be divided along the centre line. Each half must be fitted accurately to the curve of the hull and around the bulwark stanchions and they should fit closely against each other. A block of wood should be fitted and glued between each bulwark stanchion to seal the angle between the deck and side.

A rail of mahogany about $\frac{1}{4}$ in. × $\frac{1}{8}$ in. should be fitted along the uppermost plank and across the ends of the bulwark stanchions, and secured in position with pins and glue.

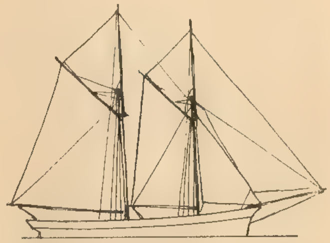
There are other items which will be obvious to the builder when he has reached this stage, but enough has been said to convince the most sceptical that a planked hull is a practical proposition for the less experienced ship modeller and, in addition, a way has been indicated by which he can gain a knowledge of ships more quickly than by any other means.

● *To be continued.*

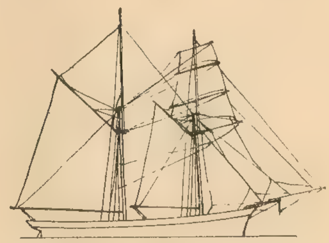
Rigged as a gaff cutter



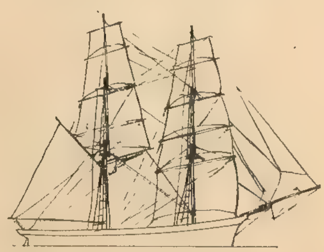
Rigged as a ketch



Rigged as fore-and-aft schooner



Rigged as topsail schooner



Rigged as a brig

Fig. 16: VARIOUS RIGS ON THE SAME HULL

Reversing by radio

EDGAR T. WESTBURY discusses methods for improving the manoeuvring controls of boats that are propelled by i.c. engines

THIS IS not an article on radio control, as such, though I hope that it will be found helpful in the practical application of radio control to models. Although I did a good deal of experimental work in the very early days of radio, long before the simple and efficient short-wave transmitters and receivers of the present day were available, I have never aspired to expert knowledge of the electronic side of the problem; I am content to leave that to the specialists, many of whom have written books and articles on the subject.

But the mechanical means of harnessing radio impulses to the control gear offer a good deal of scope for original and ingenious design, and in this respect co-operation between mechanics and electronic engineers is very desirable.

One aspect on which I have often been consulted is that of reversing gear for boats propelled by i.c. engines. It is well known that the manoeuvring of the latter is severely restricted in comparison with electrically-driven boats, where a simple reversing switch will do all that is necessary; and even on steam-driven craft the use of a twin-cylinder double-acting engine (to ensure self-starting), fitted with Stephenson link gear or other reversing mechanism, will provide a reliable means of operation adaptable to remote control.

Internal combustion engines, however, display a mulish determination to run in one direction only (who said " when they run at all " ?) and although direct reversing is a feature of many full-size marine diesel engines, the application of it to miniature engines would involve formidable problems. It is a far simpler matter to follow the practice employed in small and medium-size motor craft and fit a reversing gearbox in the transmission system.

When I described the construction of the Dolphin 10 c.c. petrol engine I stated that I had been working on the design of a reversing gear, and since then I have had many requests for further information about this. I had intended to construct the gearbox before committing it to print, but pressure of work has prevented me from going beyond making some experiments with a rough working model (no, *not* a " mock-up " as it is sometimes wrongly called—this is merely a dummy—a more appropriate term would be a " jury rig "). However, sufficient proof of the practical merit of the design has been obtained to justify publishing the drawings.

PRINCIPLES OF REVERSING GEARS

Basically, a reversing gear is a very simple device, and its essential function can be carried out in several different ways. Model engineers are obviously desirous to use the simplest possible form of mechanism—simple methods are usually the best, anyway—and they have discussed with me the possibility of using available gears or gear units which can be picked up cheaply on the " surplus " market. Some have insisted on the use of spur gears, which are much the simplest to produce in the home workshop.

Spur gears are certainly practicable for reversing, and two well-known examples of their application are found in the so-called " tumbler " gear of the screwcutting lathe, and the orthodox motor-car gearbox.

I have seen gears of the former type used in a radio-controlled boat, apparently with success, though they have two practical disadvantages for the particular purposes; first, the " crash " engagement of gears in a radial direction, and second, indirect drive (i.e. through gears) in both forward and reverse positions.

The " layshaft " arrangement of gears, as used in motor-car practice, takes the drive through the gearing only when in reverse; for forward gear, the input and output shafts are direct-coupled by a clutch, usually of the positive engagement or friction type, though hydraulic or magnetic clutches may be employed. A similar form of clutch may be used for engaging the reverse gears; sometimes, however, the gears slide into engagement endwise, which gives generally satisfactory results, though it is more liable to create damage through careless use than a clutch.

A typical example of a marine reverse gear of this type is shown in Fig. 1. The input and output shafts, on the left and right respectively, are of course separate, though axially in line, the first being coupled to the engine and the second to the propeller. A spur gear fixed to the input shaft drives the left-hand gear on the layshaft (shown, for illustration purposes, directly above it, though its position is immaterial so long as it is parallel and the gears mesh properly; it is often below the main shaft to facilitate oil bath lubrication).

A gear similar to that on the input shaft is freely mounted on the output shaft so as to be capable of independent rotation; this does not mesh directly with the gear on the right-hand end of the layshaft, but through an extra gear seen behind the layshaft on an idler shaft. This train of gears is in constant engagement, and it will be seen that the gear on the output shaft runs in the opposite direction to the input shaft and at a speed depending on the sizes of the various gears and the number of teeth in them.

The output shaft is extended through the centre of the gearbox, and carries a double clutch member, keyed or splined but free to slide so as to be capable of engaging either with the right-hand or left-hand gear member. Details of the clutch are not shown; a cone type of friction clutch is commonly used, and it is operated by the lever through a fork. It should be noted that although the gears are in engagement all the time they are only under load when driving in reverse.

Bevel cluster gears

A much simpler gear arrangement is the " bevel cluster " type which is extensively used, not only in marine practice, but also in machine tools and industrial machinery. An example is shown in Fig. 2, and it will be seen that only three gears are required, though the centre or intermediate gear is often duplicated to balance thrust or weight by another diametrically opposed to it.

The general principles are the same as before, the input shaft having the first gear fixed to it while that on the output shaft runs free, except when coupled to it by the operation of the clutch. Both these drawings are diagrammatic; the gears would, of course, normally be enclosed and operating details modified.

An actual example of a marine reversing gear embodying the bevel principle is shown in Fig. 3. In this case the box is in the form of a circular drum and revolves bodily, being keyed to the input shaft. Two intermediate idler bevel gears are employed, being mounted on a

sleeve which is prevented from rotating by keying to the rear bracket or housing, which is fixed to the engine mounting, but free to slide endwise.

The output or propeller shaft runs inside this sleeve, and can be moved endwise by the control lever, through a fork and a sleeve with double thrust bearings. On the forward movement of the lever, to the left, the cone mounted on the output shaft engages with the internal cone of the drum which, being fixed to the input shaft, gives direct forward drive.

Movement of the lever to the right, however, causes the inside of the cone to engage the external cone on the left-hand bevel gear and simultaneously pushes the entire cluster assembly to the right so that the external cone on the right-hand gear engages with the adjacent internal cone in the drum; thus motion is transmitted through the gears in the reverse direction.

The central position of the lever, of course, disengages both cones so that no drive is transmitted. An ingenious feature of this gearbox is that propeller thrust is made use of to increase the grip of the clutches in both directions so that no springs or locking devices are necessary to keep them in engagement; a thrust bearing must be fitted forward of the gearbox.

REVERSING WITHOUT GEARS

It is possible to dispense with the need for toothed gears by utilising friction transmission; the same general principle of reversing motion as in the bevel cluster can be employed, except that the essential members are in frictional instead of positive engagement.

A very ingenious reverse gear of this type has been produced by Messrs F. Bontor and R. Marshall, of the Malden S.M.E., for a large twin-screw radio-controlled model fitted with a 50 c.c. four-cylinder engine of my design. This is illustrated in Fig. 4.

The input shaft, which is continuous, and driven from the right-hand end, is fitted with two bevelled friction discs faced with semi-hard synthetic rubber. At right-angles to this two bevelled steel discs are mounted on separate shafts; they are capable of limited endwise movement, with spring loading to press them towards the input shaft. At their outer ends the cross shafts are skew-geared to short shafts disposed obliquely for coupling directly to the two propeller shafts.

Has its critics

Both friction discs on the input shaft are mounted on a splined sleeve which can be moved endwise on the input shaft in a frame mounted on slide bars, and actuated by a leadscrew, with worm gearing suitable for driving by means of a servo-motor from the radio control gear.

When the friction rollers are in the midway position relative to the discs the latter are held just barely out of engagement with either roller, but movement of the sleeve assembly brings one or other roller into frictional engagement with both discs simultaneously, transmitting motion to them in opposite directions, and through the skew gears to the propeller shafts.

This device is very well thought out and executed, and I have no doubt whatever that it would be capable of transmitting ample power for most requirements, but many constructors may consider that it involves some rather difficult operations and delicate adjustments. I know that friction gearing is objected to in some quarters, and I have been strongly criticised for using it in the M.E. Road Roller and the "1831" locomotive—though it has been proved capable of doing its job.

SIMPLE REVERSE GEAR

I have therefore designed a small bevel cluster reverse gear in which everything has been reduced to its simplest possible form, so as to provide a robust and easily-constructed device which will give reliable service for engines up to 15 c.c. capacity. It is intended to be driven through a centrifugal clutch, or other means of disengaging the engine, and it incorporates means of controlling engine speed in conjunction with both ahead and astern drive.

Before describing the construction of the gearbox I would point out that certain conditions are essential if radio control of engine manoeuvring and reversing is to be successful and reliable. First of all, the engine *must* be controllable over a fairly wide range of speed; an engine which can only be relied upon to run when tearing away flat out, or critically adjusted at one set speed, is not likely to give a realistic performance in manoeuvring, to say the least.

Even if a form of reverse gear could be made capable of being suddenly thrown over from ahead to astern, without folding up under such abuse, it would be very bad for the engine to allow it to race during transition through neutral, and the slower it can be run during this period the better.

In respect of speed control, multi-cylinder engines have the advantage in their being less likely to stall at low revolutions, but single-cylinder engines of good design and with compensated carburettors *properly adjusted* will slow down to a tick-over, and accelerate promptly again (this is most important!) by the operation of the throttle lever.

Most of my engines will conform to these conditions and other engines fitted with carburettors which I have described are also capable of control. Some spark-ignition engines with primitive carburettors can be controlled within a certain speed range

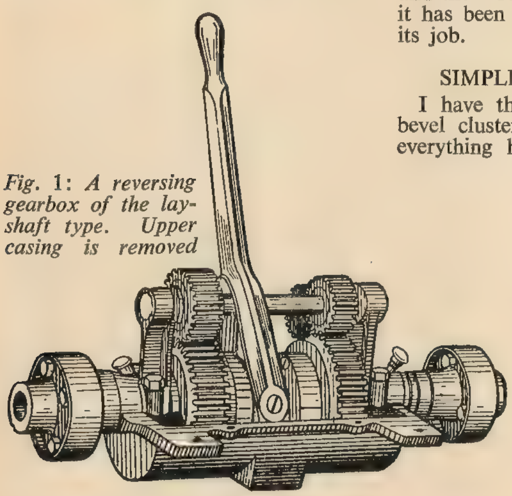


Fig. 1: A reversing gearbox of the lay-shaft type. Upper casing is removed

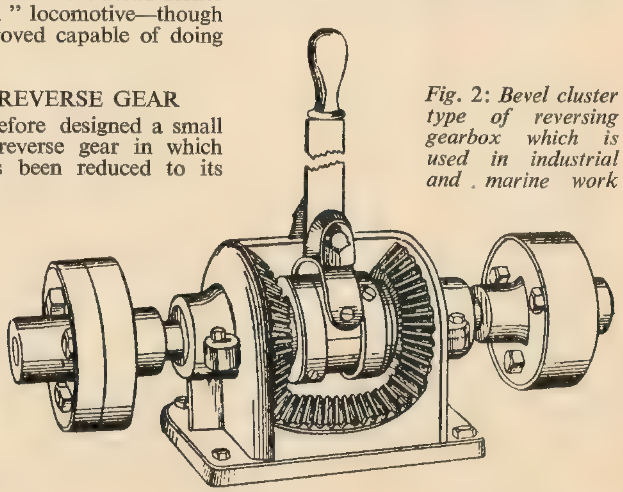
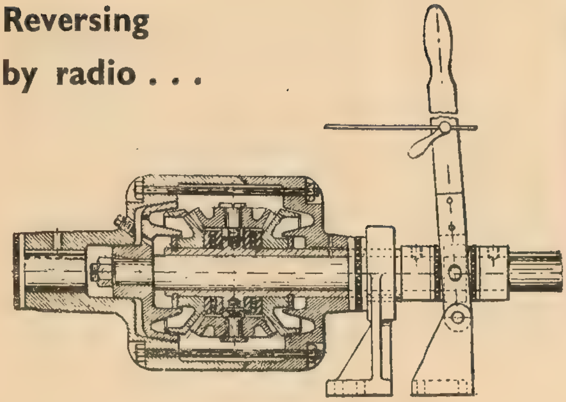
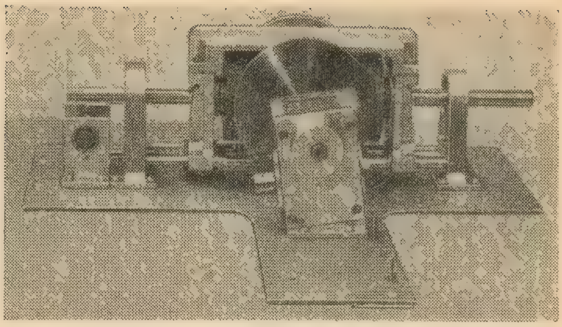


Fig. 2: Bevel cluster type of reversing gearbox which is used in industrial and marine work

Reversing by radio . . .





Above, Fig. 4: The friction-drive reversing gear by Messrs Bontor and Marshall. This is a side view

Left, Fig. 3: An example of a marine reversing gear with enclosed double-friction clutches

by the ignition advance and retard lever, but if slowed down beyond a certain limit there is a risk that loss of suction will prevent them from recovering and picking up speed again. Coupling throttle and ignition controls is a very sound policy in all cases.

The use of a centrifugal clutch, adjusted so that it disengages the drive at a speed not less than the lowest safe control speed, will enable reversing to take place without shock to the gearbox and transmission system.

CONSTRUCTION OF GEARBOX

All parts of the gearbox (shown in Fig. 5) can be machined from the solid or fabricated, though castings would simplify the work involved and enable bearers to be incorporated. The main body is an exact cube, 1¾ in. on all sides, and it can be machined from a solid block of aluminium alloy if available.

After squaring up externally, it is set up and bored right through 1⅛ in. dia., the centre portion then being chambered out to 1½ in. dia. for the same length. The top is also bored 1⅛ in. dia. to take the cover and similarly chambered out inside. Incidentally, it is not absolutely necessary to fit separate bearing endplates at both ends; one of them could be formed solid in the body; but both assembly and adjustment are simplified by making it in the manner shown.

Plain bearings are shown for both input and output shafts; some readers may consider that ball-bearings would be better, but they would have to be in duplicate both ends (four races in all) to support the two shafts properly, and if oil bath lubrication was employed, sealing rings would be desirable; so the gain in efficiency is dubious. As with most of my designs, I show the simplest form of construction which will give satisfactory results; if readers wish to improve or elaborate the design, it is up to them.

The design specifies bevels of 1 in. pitch diameter, of the type known as "mitre" gears, having an included pitch angle of 90 deg., to mesh with equal-size gears and give a ratio of 1 to 1.

There are quite a number of such gears available on the surplus market, and certain sizes are stocked by MODEL ENGINEER advertisers, including Bond's o' Euston Road and H. Moffat of Tunbridge Wells. The gearbox can thus be designed round the available gears, but I would point out that in bevel gearing it is not only essential for pitch to be correct but also for the pitch angles to be matched. In other words, it is not practicable to mesh a gear intended for 1 to 1 ratio with one intended for 2 to 1 ratio, as the pitch angles would not match. The pitch lines of two mating gears, continued to an apex, should meet exactly at the shaft centres; this is elementary geometry but it may not be universally understood.

I may mention that I have investigated the possibility of adapting complete gear assemblies, such as the spur or bevel differential gears obtained from various integrating mechanisms, but even though they are theoretically capable of being adapted for the purpose, they all involve practical difficulties in design, particularly in the accommodation of the necessary clutch and control actuator.

Steel gears are favoured, or steel and brass in combination, but the load encountered in normal service is within the capacity of all-brass gearing, though wear may be more rapid than with more durable metals.

The use of ratchet-faced dog clutches is specified as being easy to make and very satisfactory in use. Friction clutches would be very difficult to make in a gearbox of this size, and probably even more difficult to maintain in perfect adjustment. The dog on the input shaft may with advantage be formed integral with the shaft as there is not much room to fix it securely; the bevel gear should be made a press fit and keyed or pinned to it.

A centre hole is bored in the end of this shaft to form a pilot bearing for the reduced end of the output shaft, which extends right through the centre of the box and is fitted with sunk "feathers" to key the sliding dog. The opposed bevel gear is pinned or keyed to its dog, which is bored to a running fit on the output shaft. Six-toothed dogs are specified, but care must be taken to make them suit the direction of engine rotation; as shown, this is clockwise from the input end.

Oil holes

The intermediate or idler gears are mounted on stub axles in the form of bolts fitted to the sides of the gearbox, which will have to be internally spot-faced to provide seatings for them. In order to ensure lubrication, the ends of these bolts are drilled centrally and cross drilled to convey oil into the bearings, which should be bushed if steel gears are used.

It is also an advantage to drill the output shaft from the pilot end and provide one or more cross holes into the bearing of the reverse gear dog; note that when in forward gear this runs in the opposite direction to the shaft, and thus the surface speed is doubled.

The teeth on the dogs may be milled or filed to engage as closely as possible with the driving faces and dead parallel with the axis, or very slightly undercut, but not to such an extent as to be liable to lock. All faces should be smoothly finished and the three dogs, together with the stub axles of the intermediate gears, should be case-hardened. Both the input and output shafts may also be case-hardened, if this can be done without risk of distortion, otherwise

it is best to leave well alone. The keys which engage the sliding dog should be well fitted so as to ensure free and smooth motion of the latter with minimum effort.

For actuating the sliding dog, various methods are possible; a direct-acting lever which could be powered by solenoids would be simple and effective but much too abrupt in action for duty of this nature. The method I have adopted entails the use of a rotating control shaft which is required to turn through 180 deg. from full ahead to full astern, or 90 deg. for full engagement either way from neutral. It is self-locking when engaged and further incorporates means of operating the throttle control of the engine.

The top cover of the gearbox has a centre bearing for a short shaft with a disc crank on the lower end. This engages a cross-slot in a disc, to which is attached a forked tongue fitting the groove in the centre of the sliding dog. Rotation of the crank will thus move the sliding dog either to the right or the left as required; at the same time the oval cam on the upper end of the control shaft, engaging the rocking lever connected to the throttle control, gradually slows down the engine so that before complete disengagement it runs sufficiently slowly to slip the centrifugal clutch.

For simplicity's sake I have shown a control lever of more or less conventional type which could be connected in any convenient way to the control mechanism, but it would be quite easy to operate the shaft from a miniature motor mounted directly on the cover, driving the shaft by worm gearing. Limit switches to stop the motion in the neutral and engaged positions could also be fitted on the cover; it is not necessary to describe these in detail as they are an essential part of nearly all radio control systems.

Several details in the design of the gearbox, which has been simplified in all possible ways, are capable of elaboration, though whether this necessarily means improvement is open to debate. For instance, the adjustment of bevel gears to ensure silent and efficient working is somewhat critical, but the only means of obtaining this adjustment is by shims on the back of the idler gear studs, or gaskets on the flanges of the two main endplates.

The only end location of the input and output shafts is that provided by the external couplings, which must therefore be fitted to the taper seatings so that they take up play to within a few thou. No end location for the reverse bevel gear is provided at all; but the normal working thrust of bevel gears tends to push them away from the tooth face. However, it would be possible to locate this gear by a small collar on the shaft, or even a groove to accommodate a circlip. No thrust should be taken on the gearbox bearings, a separate thrust block being fitted to the propeller shaft.

● *Continued on page 515*

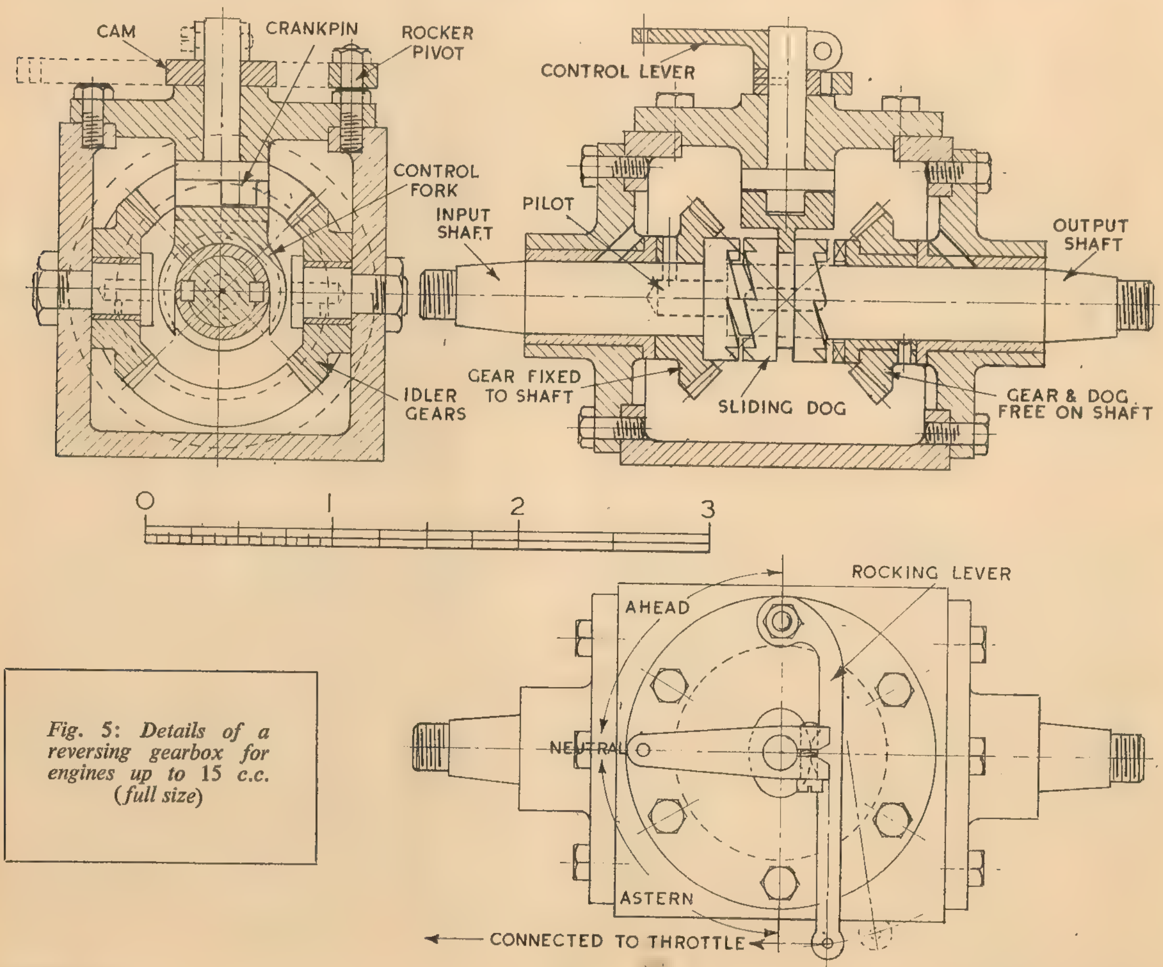
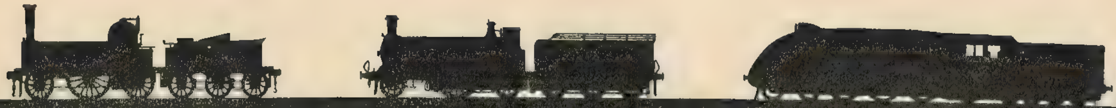


Fig. 5: Details of a reversing gearbox for engines up to 15 c.c. (full size)



LOCOMOTIVES I HAVE KNOWN

Number 30 **By**

SAMUEL JOHNSON'

MIDLAND

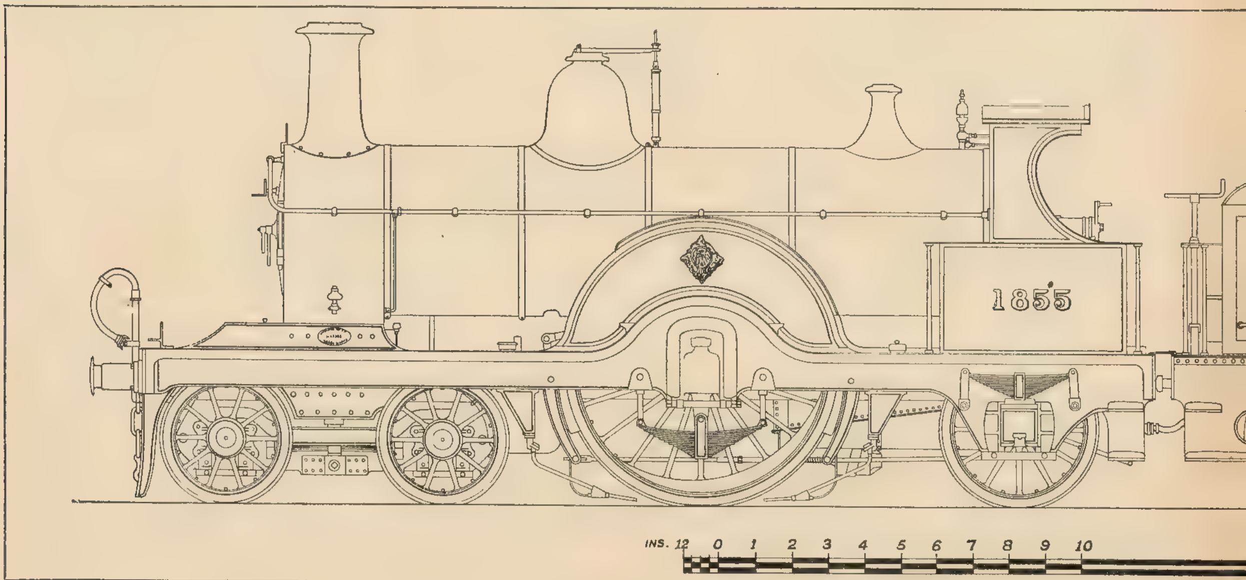
BETWEEN 1887 and 1900 no fewer than 95 of these lovely engines were built at Derby Works.

They were divided into five distinct classes: (1) with 7 ft 4 in. driving-wheels, 18 in. × 26 in. cylinders and 160 lb. boiler pressure; (2) with 7 ft 6 in. driving-wheels, 18½ in. × 26 in. cylinders and 160 lb boiler pressure; (3) with 7 ft 6 in. driving-wheels, 19 in. × 26 in. cylinders and 160 lb. boiler pressure; (4) with 19 in. × 26 in. cylinders, 7 ft 9 in. driving-wheels, and 170 lb. boiler pressure (the Spinners), and (5) with 19½ in. × 26 in. cylinders, 7 ft 9 in. driving-wheels and 180 lb. pressure.

There were 18 engines of the first class, 42 of the second, 10 of the third, 15 of the fourth and 10 of the fifth; the last two classes had piston valves instead of the usual flat valves. My drawing shows one of the second class which was the most numerous and, therefore, the most commonly seen.

The first four classes were very much alike to look at; the fifth, which was the truly grand Princess of Wales class was much larger than its predecessors. Strictly from the point of view of good looks, however, my personal preference was for the fourth class, the notorious Spinners, so called because they were holy terrors for slipping, being noticeably worse than all the others in this respect. No 118 of this class is now a B.T.C. museum piece.

But the engines of the second class were also favourites of mine; this was partly due to No 1855 having been at the head of the first Midland train I ever rode in, and also because I knew that her sister, No 1853, had won the Grand Prix at the Paris Exhibition in 1889, a fact which, for some reason or other, I found tremendously impressive.



Neat, trim, sleek, racy are adjectives that these engines deserved in full measure, though the noble dignity of my prime favourites, the G.W.R. Dean 4-2-2s, was lacking. The gracefulness and undeniable elegance of the Midland singles, however, were hard to beat, and were a tribute to that eye for locomotive beauty that made Samuel Johnson famous, even if he *did* mix up styles.

As was usual about 50 years ago, these engines were kept in spotless condition. The sumptuous coaches that made up the best Midland trains at that time were also beautifully clean; moreover, these trains were of strikingly uniform aspect from one end to the other, and the sight of one headed by a singlewheeler produced an effect that few other trains could match.

The engine and train were uniformly painted that somewhat elusive shade of crimson lake known as "Midland Red" and the result was extraordinarily pleasing, especially in bright sunlight.

Engine No 1855 and her sisters were capable of running at very high speed when they had opportunities of doing it. There were no expresses actually booked at an average speed of 60 m.p.h. in those days, but it was

by no means unknown for these engines to run the 99¼ miles from London (St Pancras) to Leicester, or vice versa, in anything between 100 and 105 minutes, in good weather, with trains of up to 180 tons.

Unfortunately, I had no actual experiences of this kind on the Midland at that time; my trips were

J. N. MASKELYNE

S 7 ft 6 in. SINGLES

RAILWAY ———

drawn until the last one was taken out of service in 1928.

It is interesting to recall, however, that the main reason why Johnson decided in 1887 to make the single-wheeler his principal express passenger engine was the invention of the steam sanding gear by a Derby engineer, F. Holt. This apparatus, by blowing a stream of sand right into the line of contact between the driving-wheel and the rail, enabled a singlewheeler to obtain a better grip on the rail when starting from rest.

Incidentally, the first engine ever to be fitted with this device was Caledonian Railway No 123 (see article No 11); but in her case it was operated by compressed air and not by steam.

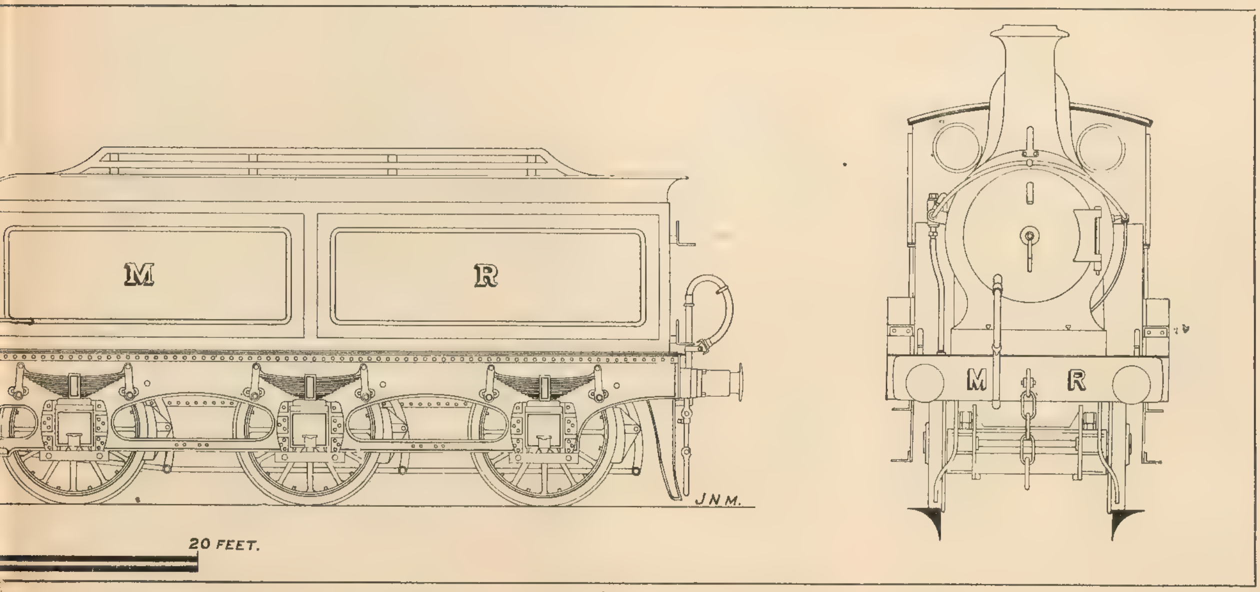
The dimensions of No 1855 and her

single direct-loaded valve placed on the top of the firebox and enclosed in a very shapely cover of brightly polished brass.

The Salters were set to blow off at the normal pressure of 160 p.s.i., while the firebox valve came into operation if the pressure should happen to reach 162 p.s.i. I often saw all three valves working merrily, showing that those Johnson boilers could make plenty of steam; and it usually happened just before the driver was given " Right Away " from a station platform.

The tender had 4 ft 2 in. wheels on a wheelbase of 13 ft equally divided; its overhangs were 4 ft at the front and 3 ft 6 in. at the back.

It is interesting to recall that 93 of the Johnson 4-2-2 engines survived to



confined to semi-local trains to such places as Radlett, St Albans, or Bedford. But singlewheelers were often on these turns and usually ran well between stops.

I remember an evening non-stop train from St Albans to St Pancras that was allowed 29 min. for the 20 miles and gave a singlewheeler some scope for showing what she could do, especially between Elstree and Cricklewood, a stretch over which the average speed was often as high as 70 m.p.h., though the maximum did not as a rule exceed 75 m.p.h.

The Midland Railway's faith in its singlewheelers was extraordinary, if not unique. But the engines must have justified it, for they were in constant use on the main line until 1925, and were then gradually with-

41 sisters were: cylinders, 18½ in. dia., 26 in. stroke; diameters of wheels were, bogie 3 ft 6 in.; driving, 7 ft 6 in., and trailing 4 ft 2½ in. The wheelbase was 21 ft 10½ in. divided into 6 ft plus 7 ft 1½ in. plus 8 ft 9 in., while the overhang was 2 ft 3 in. at the leading end and 3 ft 8 in. at the back.

The boiler was a very good one; it was made in three rings, the diameter of the largest of which was 4 ft 2 in. The barrel contained 242 tubes of 1⅝ in. dia., and two of 1½ in. dia., the heating surface of which amounted to 1,123.6 sq. ft; to this the firebox added 117 sq. ft, so that the total heating surface was 1,240.6 sq. ft. The grate area was 19.68 sq. ft.

There were three safety-valves, two of the Salter spring-balanced type being mounted on the dome, and a

become the property of the London Midland and Scottish Railway in 1923, and therefore were the only singlewheelers, other than the ex-Caledonian No 123, to work on British railways after the grouping.

During the next five years, the majority were used for piloting express passenger trains on the London-Derby-Manchester and the Derby-Bristol routes. I do not think that any of them ever worked north of Derby to Carlisle, as the gradients on that line were too severe for them.

I must mention that in the war period 1914 to 1918 it was not unusual to see some of these normally swift locomotives piloting heavy goods trains and coal trains from Toton to Cricklewood sidings, a job for which they were obviously unsuited. ▣

VIRGINIA

Continued from 28 March 1957, pages 467 to 469

L.B.S.C.'s article on the old-time American locomotive this week deals with a suitable tender for the engine with the larger boiler

WHEN I first erected a little straight railway line in the back garden of my old home at Norbury it proved of great interest to three schoolboys who lived next door.

Once when I was trying a partly-finished engine with a tender which belonged to another one, one of the boys called out, "Lummy, don't she look scatty!" and that non-U but very true remark would just about apply to a *Virginia* with the larger boiler and modern type of cab if it were coupled to the old-fashioned type of tender. I am, therefore, offering some notes and drawings for a tender of more modern vintage.

There is no need to make any alteration to the frame, tender trucks or any of the running-gear; they will suit the alternative tender body quite well. The soleplate of this one can be made from a piece of 16-gauge sheet brass, hard-rolled for preference, $16\frac{7}{8}$ in. long and $6\frac{3}{4}$ in. wide. The corners should be rounded off to about $\frac{1}{4}$ in. radius instead of the big radii of the small tender. It is attached to the frame by pieces of angle in exactly the same way.

Make it in one piece

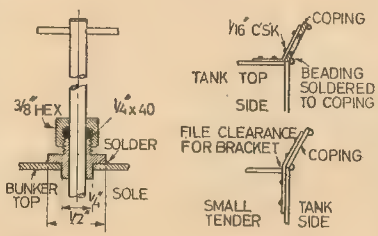
If a sufficiently long piece of 5 in. wide 18- or 20-gauge sheet brass is available the sides and back of the tender can be made in one piece by the method described for the smaller one. Otherwise, make it in two pieces, each comprising one side and half the back with a butt-joint in the middle of the back section. There is no separate coping to this type of tender, the extra height at each side of the coal space being part of the tender side sheet.

To keep the side sheets perfectly flat I strongly advise cutting the brass sheet to outline with a metal-piercing or coping saw, smoothing off any sawmarks with a fine file. The corners at the back and the rounded front ends can be bent over a piece of round bar held in the bench vice.

To keep the construction as simple as possible, there are no actual water legs to the tank, although the appearance is O.K. Neither is the coal space made hopper-shape. To be quite frank, a hopper-shaped coal recess on a little engine is just a confounded nuisance from which to shovel up the little black diamonds when the engine is running; I find it far easier if the flat space extends the full width of the tender so that you can get the shovel underneath the coal. This type is shown.

The front plate is made from a piece of 16- or 18-gauge brass sheet, $3\frac{1}{2}$ in. wide and $6\frac{7}{8}$ in. long, which is bent at right angles at a bare $\frac{5}{16}$ in. from each end so as to fit nicely between the side sheets of the tank, and keep them parallel.

Before fixing this, cut a gap in it 2 in. wide and $1\frac{7}{8}$ in. deep for the coal-gate opening. At each side of this rivet a runner, made in the same way as the runners described for the sliding roof of the cab. The gate itself is just a piece of sheet metal (steel will do) cut to slide between the runners and furnished with a knob so that the fireman can lift it easily.



The gland for the injector water-valve spindle; and an alternative method of attaching the tender's coping

The completed front plate can be riveted in position, butting it up tightly against the semicircular front ends of the side sheets as shown in the plan. If the builder happens to be one of those good folk who delight in seeing a rash of pimples all over a tender he can put in as many rivets as desired and snap the heads on the outside of the tank sheet. This applies to all the riveting.

Personally I prefer a smooth sheet, like those on the old Brighton engines, and the cleaner-boys certainly liked to wipe smooth sheets instead of knobbly ones!

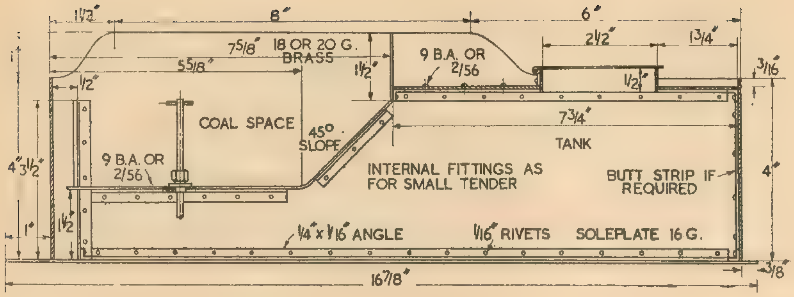
TANK AND BUNKER

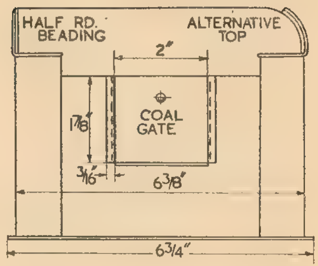
Pieces of $\frac{1}{4}$ in. × $\frac{1}{16}$ in. brass angle are riveted along the full length of the tank body at the bottom edges and also along the back. Similar pieces are also needed to support the bottom of the coal bunker and the removable part of the tank top. To make certain that the "floor" is level my usual dodge is to cut out a piece of cardboard showing its height from the tank bottom and the upward slope to the partition. This is placed in the tank body at each side and a line scribed along the upper edge of the template on the brass sheet.

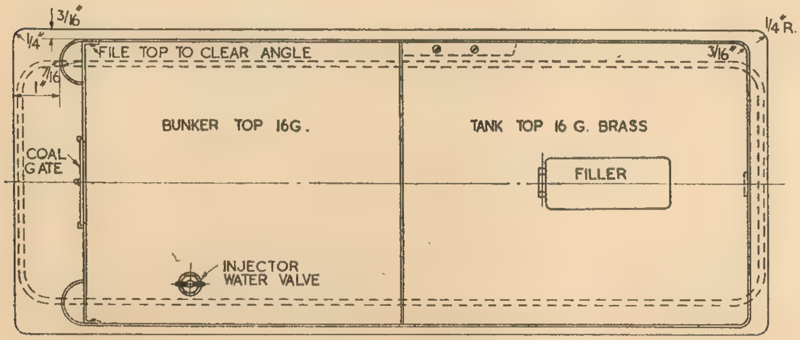
These lines must of necessity be the same height from the tank bottom, and the pieces of angle are riveted flush with them. The pieces of angle for supporting the removable part of the tank top are riveted along the top and back at $\frac{3}{16}$ in. from the upper edge. Another piece of angle is riveted to the back of the partition, as shown in the section, to support the front end of the removable tank top.

The bottoms of the coal bunker and the partition are made in one piece from 16-gauge brass full $6\frac{3}{8}$ in. wide, to fit nicely between the tank sides, the length being $9\frac{1}{2}$ in. Cut this away at each side at one end, for $\frac{1}{4}$ in. depth, leaving a tongue in the middle 2 in. wide to fit the bottom of the coal-gate opening. At 5 in. from the shoulders bend the sheet upwards at 45 deg. angle, and at $2\frac{3}{4}$ in. above that, bend it again vertically; see section of tank body. The angle for supporting the front end of the tank top is riveted just above the second bend.

Before screwing this down permanently, erect the tank body on the soleplate. First drill a series of No 41 holes at about $1\frac{1}{2}$ in. centres, right along the bottom angles, both sides and back. Stand the body on the soleplate in the position shown, with $\frac{3}{16}$ in. of the soleplate projecting at







Side and front elevations and plan of VIRGINIA's *' tender*

each side and the front curves 1 in. from the front edge. Tack it in this position with a few blobs of solder along the bottom; say one at front and back, and two at each side.

Fix up a couple of extension drills, Nos 41 and 48, driving them into holes drilled in the ends of pieces of $\frac{3}{16}$ in. rod about 6 in. long. All broken ends of drills should be saved for making these very useful extensions; in fact a broken end is far better for the purpose than a new drill as there will only be a short piece projecting from the extension rod.

Using the holes in the angles as guides, make countersinks through all of them on the soleplate; drill through with the long-necked No 48 and tap 3/32 in. or 3/48. To drive the tap, take a piece of tube about 6 in. long, of a diameter that will just go over the square on the shank of the tap, and hammer the end down on to the flats so that the tube becomes a square-holed box-spanner. Put your tapwrench on the other end, and the tapping becomes a piece of cake. A taste of cutting oil on the tap will make it cut wonderfully easy.

When all are tapped, put in brass screws—any heads will do—and then solder all round the bottom and over the angles and screwheads, just as described for the smaller tender. The bottom of the coal bunker can then be fitted. Place it in position temporarily and make any adjustment that may be needed to the bends and width; remove it and drill a series of holes at about $\frac{3}{4}$ in. centres, 5/32 in. from the edge, along the level part and up the sides of the slope. Use No 48 drill and countersink the holes.

Replace the plate, see that the tongue goes through the coal-gate opening right at the bottom so that the shoulders at each side of it fit tightly against the front plate, then make countersinks on the angles with the No 48 drill through the holes in the plate; follow through with No 53 drill, tap 9 B.A. or 2/56 and put countersunk brass screws in.

These are necessary in the present case as cheese or roundheads would catch the shovel. Sweat over all the joints and screwheads with solder and don't forget to do the piece under the tongue where it projects through the front plate.

The vertical section at the back of the coal-bunker which forms a division-plate can either be soldered to the sides or fixed with a small piece of angle close to the top, at each side.

REMOVABLE TANK TOP

The cover over the rear part of the tank is made from a piece of 16-gauge brass sheet measuring approximately $6\frac{1}{4}$ in. × $7\frac{3}{4}$ in. It should be trimmed to fit nicely between the sides and ends. At $1\frac{3}{4}$ in. from the back end cut a rectangular hole $2\frac{5}{8}$ in. long and 1 in. wide, with rounded corners; and in it fit a filler with hinged lid, as described for the smaller tender.

At 5/32 in. from the edge, all around the plate, drill a series of holes at about $\frac{7}{8}$ in. centres with No 48 drill. Put the plate in position, make countersinks through the holes with the 48 drill on the angles, drill through with No 53 drill and tap 9 B.A. or 2/56. Don't put any screws in yet as the top has to come off to fit the emergency hand-pump.

The internal fittings of the larger tender tank are exactly the same as described in the previous instalment and may be fitted in approximately the same position in each case. There is, however, a slight variation in the fitting of the injector water valve. The spindle of this passed through a plain bush in the top of the smaller tank, which was all right as it was well above water level; but in the present instance it passes through the bottom of the coal bunker, and a plain bush would let water escape all the time the level was above the bush.

A gland will, therefore, be required here and a section of a suitable one is shown in the detail sketch. Chuck a piece of $\frac{1}{2}$ in. brass rod in the three-jaw, face, centre, and drill to a bare $\frac{1}{2}$ in. depth with No 21 drill. Turn down $\frac{3}{16}$ in. length to $\frac{1}{4}$ in. dia. and screw $\frac{1}{4}$ in. × 40. Part off at $\frac{3}{16}$ in. from shoulder; reverse in the chuck, holding in a tapped bush, and turn $\frac{1}{8}$ in. length down to $\frac{1}{4}$ in. dia. Make a gland nut to suit from $\frac{3}{8}$ in. hexagon rod, the same as a union nut.

When drilling the hole in the soleplate for the insertion of the water-valve, let the drill carry right on until

VIRGINIA . . .

it goes right through the bottom of the bunker. The holes will then be in alignment—they couldn't very well be otherwise !

After fitting the valve, solder the bottom part of the gland into the hole in the bunker bottom and before inserting the spindle through it don't forget to put the gland nut on the spindle, with a few strands of graphited yarn inside it. Screw the spindle home, tighten the nut just sufficiently to compress the packing and there won't be any leakage.

COPING FOR THE SMALLER TENDER

The flared coping which is fitted around the top of the smaller tender is made from a strip of 18-gauge brass $\frac{5}{8}$ in. wide and should be in one piece if a sufficient length is available. If not, the joint can be made in the middle of the back, same as the body. Most amateur metal workers find difficulty with the corners. If they were square, like many of the British tenders of the same period, it would be easy enough to mitre them, making the coping in three pieces with the joints at the mitred corners; but *Virginia's* full-size relations had rounded corners to the coping.

About the easiest way to reproduce these in the small size is first to bend the strip to the shape of the tender top, then put a piece of round rod in the bench vice with an inch or so projecting at the side of the jaws. Lay the bend over this and beat the edge nearest the vice with a hammer. This will stretch the brass sheet, and as the beaten edge will be longer than the unbeaten one the strip will assume the desired splayed-out appearance. It only needs a little practice to make a neat job without any hammer marks.

As a matter of fact I don't bother to make separate coping strips at all. I make the coping in one piece with the tender, one example being the tender for my Webb compound. The upper part of each side and back was bent over to the desired flare to within about $\frac{3}{4}$ in. of the corners, and these were then splayed out in the above way until they lined up with the straight sections.

Another way would be to get a piece of hardwood about 3 in. square and 1 in. thick, plane off two adjacent sides to the required angle and file the corner to match. The strip could then be placed on this and carefully hammered into contact with it. The brass would need well softening before commencing operations, and re-annealing if it " went hard " during the process.

After forming the corners, the coping can be attached to the tank top by either of the methods illustrated. Small brackets made from $\frac{1}{4}$ in. strip brass can be attached to the inside of the coping at about 2 in. intervals, either by riveting or soldering, and the lower ends of these can either be attached to the top plate of the tank or to the inner side of the tank sides.

In the former case the coping comes away with the tank top if same is removed. In the latter, it is a fixture, and small clearances would need filing in the top plate to clear the brackets. A beading of 3/32 in. half-round wire, nickel-bronze (German silver) or brass, can be soldered around the top edge and another at the joint between the coping and the tender sides, as shown in the general arrangement drawing of the tender. A similar beading can also be used around the top edge of the larger tender.

Beginners may find the following tip useful when doing the last-mentioned job. It needs neat soldering to preserve a good appearance, and the beading must be kept tightly in position when soldering; if it isn't, immediately the hot soldering-bit is applied it will expand and pull away from the tender sheet or coping. I got over this trouble by making some weeny cramps from $\frac{3}{16}$ in. square rod and 3/32 in. screws.

Soldering the beading

The end of the beading was set in position and secured by one of the cramps, then three more were attached at about $1\frac{1}{2}$ in. intervals, holding the beading tightly to the tender side in line with the top edge. Some liquid flux was applied along the top edge so that it ran between the beading and the tender side, and then the hot bit with some solder on it was applied to the same places.

The solder sweated down between beading and metal, and when the spaces between the cramps were done the cramps were shifted along and the process repeated until the end of the beading was reached. The places where the cramps had been attached were then soldered, thus making a continuous run.

Any traces of solder along the top edge were filed off and any that had seeped through and were showing below the beading were scraped off with the ex-file scraper mentioned last week. When I use nickel-bronze half-round wire for beading I always leave it bright; the effect is pleasing, whatever the colour of the locomotive.

BOILER CLEADING

Uninitiated folk usually get mixed up with " lagging " and " cleading." Lagging is the wood strips, felt, asbestos mattress, or other material used to prevent dissipation of heat from a locomotive boiler, and cleading is the term used for the plates and bands which keep the lagging in place. At least, that was the way of things in my time on the L.B. and S.C.R.—maybe they have other terms in use now in the " motive power depots ".

Anyway, all the covering that the *Virginia* boilers need will be a thin brass or copper plate over the firebox wrapper to hide the stayheads, and this can be fixed at the bottom edges by three or four $\frac{1}{16}$ in. or 1/72 round-head screws tapped into the boiler. In addition, the smaller boiler needs a coned section to simulate the wagon-top between barrel and firebox wrapper.

To get the exact shape of the piece of metal required, cut out a paper pattern and wrap it around the boiler so that it touches both the barrel and the top of the wrapper. Run a pencil around it and mark where it needs cutting, to get the ends square, then take it off and cut it at the marked lines.

The result will give you the exact shape and size of the piece of metal. Cut this to the shape and size indicated, bend it around the boiler, and secure it with three or four small screws underneath. Alternatively, bend the edges at right angles like a clip and put two $\frac{1}{16}$ in. bolts through the angles.

I make all my boiler bands from what is known in the metal trade as " ticket wire ". This is thin brass strip about $\frac{3}{16}$ in. wide. The bands are made by simply bending a length of this around the barrel, cutting it at the overlap, bending the ends at right angles clip-fashion and putting a $\frac{1}{16}$ in. bolt through. When attaching a band to a firebox I just fix it with a screw at the bottom on each side.

● *To be continued.*

The after deckhouse as seen from the quay

A WORKING MODEL OF ST NINIAN

By EDWARD BOWNESS

Part 7.—Planking and the after deckhouse form the subject of this week's constructional details of a cross-Channel steamer

Continued from 21 March 1957, pages 423-425

THE DECK PLANKING should now be taken in hand. On the ship herself the planks are 5 in. wide, which if made to scale for the model would be 3/32 in. wide. For an exhibition model there would be no question of not making them to scale, but for a working model I consider something more robust is required. I propose, therefore, to make them $\frac{1}{8}$ in. wide.

Planking a deck is pleasant work, for once the strips are prepared it is not difficult and the result, as compared with a deck marked out with ink or pencil, is much more satisfying. In the drawing of the afterdeck, Fig. 29 [March 21] the run of the planking is drawn to scale. A strip $\frac{1}{4}$ in. wide $\times$ $\frac{1}{16}$ in. thick runs all round the outer edge of the deck plate from the ventilator casing on the starboard side to the midship superstructure on the port side, the only interruption being at the port-side ventilator casing.

The notches for the ends of the planks on the quarters should be omitted for the present. The inside of the strip should be cut square and smooth, and the outside should be cleaned off flush with the outer edge of the deck plate. The strip should be cemented firmly in position, carefully cleaning off any adhesive left on the inner side.

Technically this strip is the "covering board," its name being derived from the fact that the corresponding plank in a wooden ship covers the ends of the frames of the hull. For improved appearance this is often made of darker coloured wood than that which is used for the planking. In some models I have used walnut, but perhaps a lighter-coloured wood would be more realistic.

Sycamore is, I think, the most suitable wood for the planks. It has a close grain, takes a fine finish, and resembles the pine usually used for decks, especially when bleached by weather and scrubbing.

A good number of strips, $\frac{1}{8}$ in. wide $\times$ $\frac{1}{16}$ in. thick, should be prepared in fairly long lengths to prevent undue waste. The width should be accurate to dimensions so that the planks lie symmetrically on each side of the ship.

Beginning at the stern the two planks at the centre line should be laid first, continuing until 14 are laid on each side. These fit between the covering board and the flange for the after deckhouse. The fifteenth plank is notched into the covering board, the width of the square at its tapered end being half the width of the plank. The rule is that if the length of the tapered part is more than twice the width of the plank where the plank fits against the covering board, the end should be squared and the covering board notched to suit.

I have shown 11 planks notched into the covering board on each side. I am not sure if the rule applies further forward, but those which are shown thus make an interesting pattern and at least comply with those on the ship. In laying decks I have found that the long taper on the planks approaching amidships enables one to drive them in between the preceding plank and the covering board and thus helps to wedge them tightly against one another.

Sequence of planking

Deck planks are not usually more than about 20 ft long. The butts where the ends meet are arranged in such an order that there are always three or four widths between each butt. In the full-size drawing a suggested arrangement of the butts is shown. The sequence commences at the midship superstructure on the port side and at the after side of the large hatch on the starboard, in each case working from amidships outward, the order being 5, 2, 4, 1, 3 or, in terms of the length of the planks, 20 ft, 8 ft, 16 ft, 4 ft and 12 ft.

Naturally this does not apply in those portions of the deck where the planks are less than 20 ft. From a study of the full-size drawing of the after deck, Fig. 29, the sequence of the butts will be clearer than is possible with the written description; also it will be appreciated that where butts are necessary it is important to have them "shipshape and Bristol fashion."

THE AFTER DECKHOUSE

It will be appropriate at this stage to make the after deckhouse. It is a fairly straightforward job and to one who has had no previous experience of tinplate ship modelling it will provide an opportunity for learning something of the technique before tackling the more complicated job of building the midship superstructure.

We can leave the rails, ladders and docking bridge fittings until later and concentrate on the house itself. The important thing to be noted is that while the walls and corners are vertical the roof and base follow the lines of the ship, sloping downwards at the stern toward amidships and curving athwartship with the camber of the deck.

Attention to these points is essential; so many people associate the sheer of a ship only with the sheer line or the upper edge of the sheer strake of the hull, whereas the sheer runs through the whole structure of the ship and gives it that grace and beauty which is the hallmark of a fine ship. The promenade decks, the boatdeck, the wheel-house top and the docking bridge are all parallel with the sheer line, and each deck is cambered, in some cases the upper decks having more camber than those beneath them.

In *St Ninian* the front of the midship superstructure slopes aft as it rises, in conformity with the modern tendency, but otherwise all bulkheads, posts, davits, ventilators, windows and doors are vertical.

In view of the rounded corners it is advisable to make the sides of the house in one piece with a butt joint on the centre line of the curved forward side.

A paper template should first be made, stretching it around the flange at the opening in the deck and securing

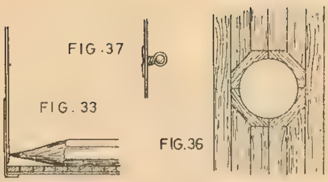


Fig. 33: *Method for marking the outline of the deckhouse*

Fig. 36: *The planking arrangement round ventilator shafts*

Fig. 37: *A suggested bracket for the handrails in houses*

it with a rubber band or other suitable means. The length will be about 20 in. and the width 2 in. With the corners and sides vertical it will be found that the template touches the deck only at the centre line of the after side of the house.

The position of the centre line of the ship should be clearly marked on it at each end and then a line should be scribed all round the base at about $\frac{1}{8}$ in. above the deck. This can be done conveniently with a pencil laid on the deck as shown in Fig. 33. Remove the template and draw on it a second line parallel to the first and 1.6 in. above it as shown in Fig. 34.

Mark out the position of the doors and portholes to the particulars given and paste the template on a sheet of tinplate. This should be of the same or a little lighter gauge than the tinplate used for the hull. Carefully cut it to shape and drill the portholes. The doors should be scribed on and not cut out. They will be painted later, but in any case they are not very conspicuous, being somewhat hidden by the wings of the docking bridge.

The strip should now be tried on the flange around the hole in the afterdeck and after making sure that its lower edge follows the contour of the deck, and cutting the ends to make a clean joint, the ends should be tinned on the inside and a butt strap $\frac{1}{4}$ in. wide prepared and tinned.

The butt strap should project $\frac{1}{8}$ in. above the upper edge and the projection bent back at right angles so that its upper face measures rather less than 1/32 in. below the upper edge of the strip. This upper edge should be tinned all round so that, later, the roof can be soldered to it. The strip should be clamped around the flange with the butt strap in position, when the joint can be soldered.

The roof, or docking bridge, can be marked out from the sides which are still left in position on the flange, the material being sufficiently large to contain the wings of the bridge and the platform for the stair down to the deck. The dimensions for these are given on Fig. 35. This should be cut to be a close fit inside the sides of the house, clearance being cut to receive the wings and the platform before mentioned. This clearance should be rather less than 1/32 in. deep.

The roof is tinned around its entire edge on the underside for a width of $\frac{1}{8}$ in. to $\frac{1}{4}$ in. It is placed in position, its forward end resting on the flange of the buttstrap and the remainder on the wings of the bridge and the after platform, after which it can be tacked at half-a-dozen points to hold it securely.

The house may now be taken off its flange, turned upside down and a good fillet of solder run all round the inside angle to secure the roof firmly to the sides. Turning it back again the sides should be filed and finished off flush with the roof so as to make a level base for the angle which is to be soldered to it later. The portholes are glazed, as described for the ports in the hull, and the interior painted.

So far I have made no mention of painting; but the first operation after finishing the hull, or any structure such as the deckhouse just described, is to give it at least one coat of good lead paint, taking care that it goes into all the crevices and corners to ensure a complete coat.

Tinplate is liable to rust at the edges where the coating of tin has been cut and at any place where it has been worn off, and painting as a preventive measure is important. The outside of the hull and of any house or part of the superstructure to which fittings have to be added later should not be painted at too early a stage.

If the roof of the house, or docking bridge as we can now call it, has been soldered to follow the upper edge of the house sides it will automatically have the correct camber. This camber continues to the ends of the wings which are in line with the sides of the ship, so that on each side there will be a perceptible downward slope outwards.

The rail stanchions are vertical and this tends to emphasise the slope of the wings. Underneath the wings of the bridge there are flanges about 10 in. deep all round the edges to support the wings. These can be made from a strip of tin $\frac{3}{16}$ in. wide soldered in position, and with a narrow flange at each end which is soldered to the side of the house. The outer corners of this flange are provided with angle-iron pillars to support the bridge from the deck. One of these can be seen in the photograph of the deckhouse reproduced at the head of this article.

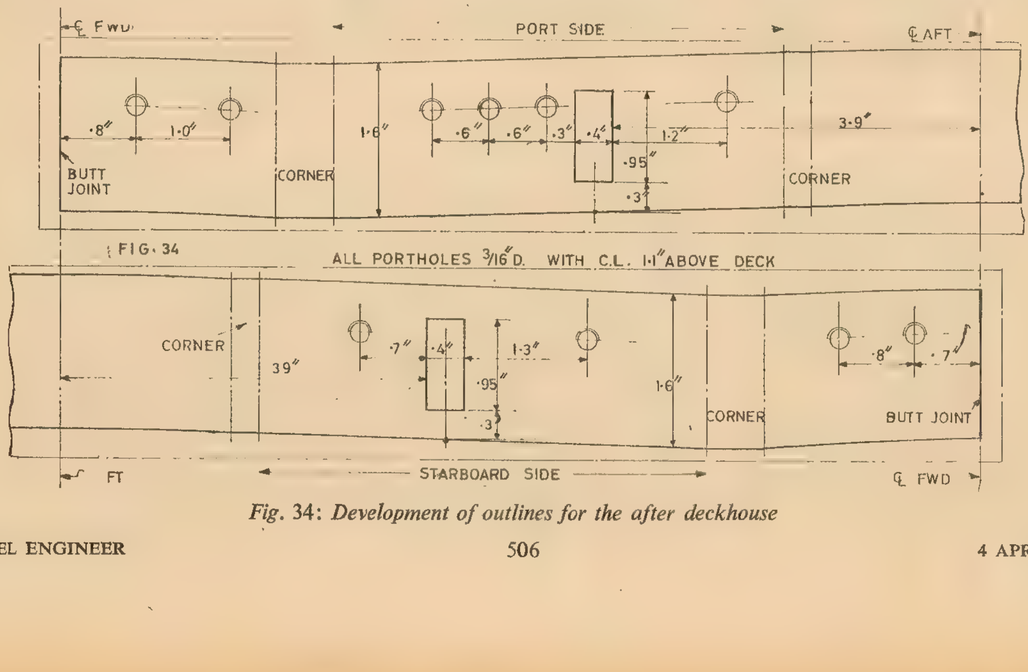


Fig. 34: *Development of outlines for the after deckhouse*

There is a triangular web at the base which should be bent at right angles and soldered to the angle inside the sheer strake. The pillars should be made from $\frac{3}{16}$ in. strip folded at right angles and soldered inside the flange at the top and to the triangular web at the base. The platform for the stair, which is clearly shown in the photograph, is supported only by brackets projecting from the side of the deckhouse.

The end of this platform should be left $\frac{1}{8}$ in. longer than the dimension so that it can be bent down at right angles to form the outer flange. The side brackets should be cut from tinplate to the shape shown, and soldered in position.

Make rail a fixture

Around the top of the house and its wings there runs an angle-iron about 6 in. × 6 in. to support the stanchions (or the sockets into which the removable stanchions fit) and to provide protection for the ends of the deck planks. The rail on the starboard forward corner of the house is removed when in port to avoid damage when cargo is being handled by the aftermost crane which is pivoted not far away.

We can ignore this in our model and make the rail and its stanchions fixtures throughout. The angle should be made from a strip of tinplate or brass 0.2 in. wide folded through a right angle throughout its length. It is mitred at the corners of the wings and platform and should be built up for the rounded corners. It is then soldered in position and forms a neat finish for the roof of the deckhouse.

The deck can now be planked, using strips of sycamore as for the afterdeck. These will be $\frac{1}{8}$ in. wide × $\frac{1}{16}$ in. thick as before. There is no covering board around the edges, the planks being fitted close to the angle-iron all round. The butts are arranged as for the afterdeck, giving four widths between each butt and using the same sequence, viz. 5, 2, 4, 1, 3. The arrangement which is shown in Fig. 35 reduces the number of butts and the number of planks over 4 in. long to a minimum.

There are three rather prominent cowl ventilators on the roof of this house and the holes where they pass through the roof receive special treatment as regards the deck planking. This is shown in Fig. 36. The actual dia. of the ventilator shafts is 25 in. in each case, and they communicate with the accommodation for cattle in the 'tween decks. An octagonal space is cut out of the planking, four or five planks being involved in the model, and the space around the ventilator pipe being filled

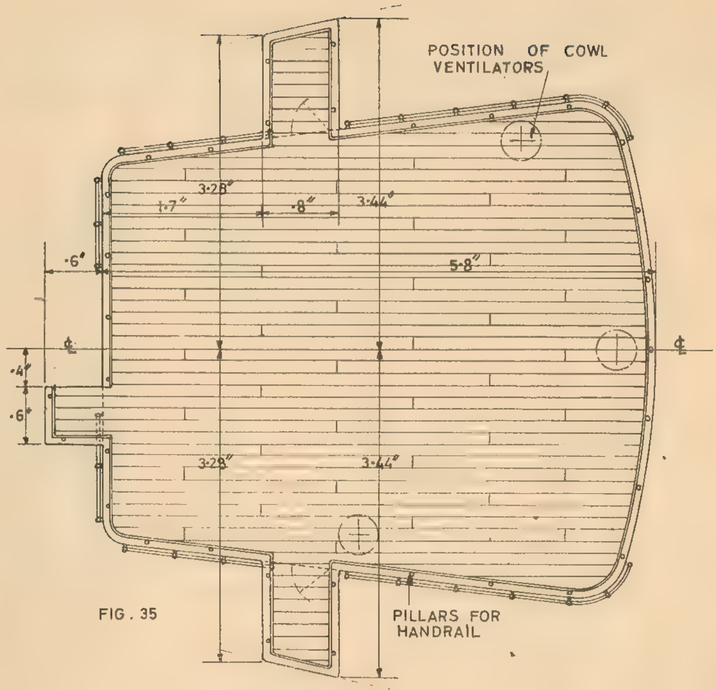


Fig. 35: *Plan of docking bridge showing planking*

in with four blocks shaped and fitted as shown in the drawing.

However, this refinement is only for the purist making an exhibition model. Personally I consider it sufficient to have a flange on the base of the cowl and to secure it to the deck planking by means of screws from below. The positions of the ventilators are shown in Fig. 35.

The handrails on the sides of the deckhouse could be fitted at this stage. They are shown in plan in Fig. 35 and are 3 ft 6 in. (or 0.7 in. in the model) above the level of the deck. They consist of pieces of 16 s.w.g. brass wire, and the supporting brackets are made of 20 s.w.g. wire flattened in the middle, bent round the rail, given a double twist behind it, and the ends pushed through holes drilled in the house at the appropriate places to receive them.

The ends of the wire are then spread out inside the house and secured with a touch of solder, see Fig. 37. It may be that these ends form a projection on the inside which fouls the top of the locating flange. If this is found to be the case notches should be cut in the flange to clear them.

Reverting to Part Six: The casings on each side of the deck at Station 2 are vents from the holds. They could be made of wood, screwed and cemented to the bulwarks, with a flanged metal plate screwed on the top to represent the overhanging cover. This is shown in Fig. 32 (21 March, 1957).

The cover on the port-side vent should be made to take off, so that when the deckplate has to be removed it can be lifted off, after which the deckplate can be raised on this side and drawn away from the other.

The vents are mounted on a plate on the side angle which extends $\frac{3}{16}$ in. or $\frac{1}{4}$ in. beyond the base to enable a watertight joint to be made at this point when the deckplate is screwed down. The picture of the after deck on the port quarter shows the appearance of one of these casings on the ship.

It will be noticed from this picture that the midship bulwark on the port side is slightly different from that on the starboard side [shown in Fig. 16 in the issue of 21 February 1957]. The portion 40 in. deep from the vent to the midship superstructure should be cut down flush with the top of the sheer strake and, instead of the plain railing shown in the profile drawing of the ship, it has the ordinary side rail with a teak rail on top.

This area on the starboard side is closed to passengers and the teak topped rail is unnecessary.

● *To be continued.*

EXPERT'S WORKSHOP ..... by Duplex

A lathe filing attachment

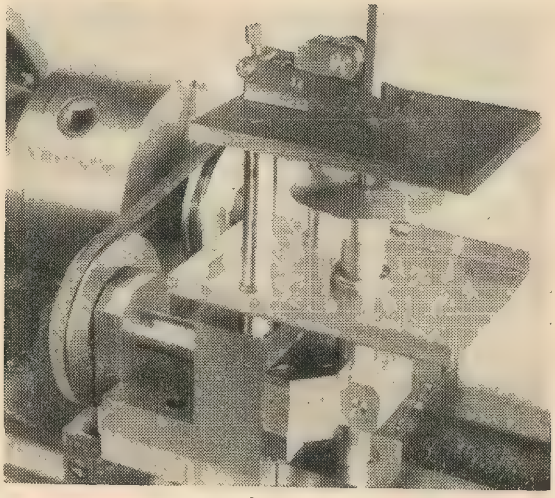


Fig. 1: The finished filing attachment mounted on the lathe cross-slide

A FILING ATTACHMENT for doing accurate work on small parts can readily be mounted on either the lathe bed or the cross-slide, where it is secured in place by means of a clamp-piece or a single T-bolt.

This arrangement has the advantage that the full range of mandrel speeds is available for operating the file so as to meet various working conditions. Moreover, once an attachment of this kind has been made it can, if required, be converted into a machine unit by mounting it on a baseboard and installing a self-contained motor drive.

When designing the attachment various fundamental requirements were regarded as essential for obtaining satisfactory operation under all normal conditions. Therefore, included in the design were: the provision of an efficient lubrication system to minimise wear in the working parts and an effective guard or deflector to prevent the filings from getting into the moving parts of the machine.

Great importance was also attached to reducing the weight of the reciprocating parts as much as possible without endangering their strength; this was done by drilling away unnecessary metal and at the same time using light alloys when mechanically justified. In addition the design was intended to provide against wear by enabling any slackness to be taken up should it develop in the main working parts after prolonged use.

Although various designs for a machine of this kind have appeared from time to time, none as far as is known has until now incorporated all the above features in a single machine.

One of the first points that has to

Fig. 2: The base casting: (a) end elevation; (b) side elevation; (c) plan view; (d) reversed plan view

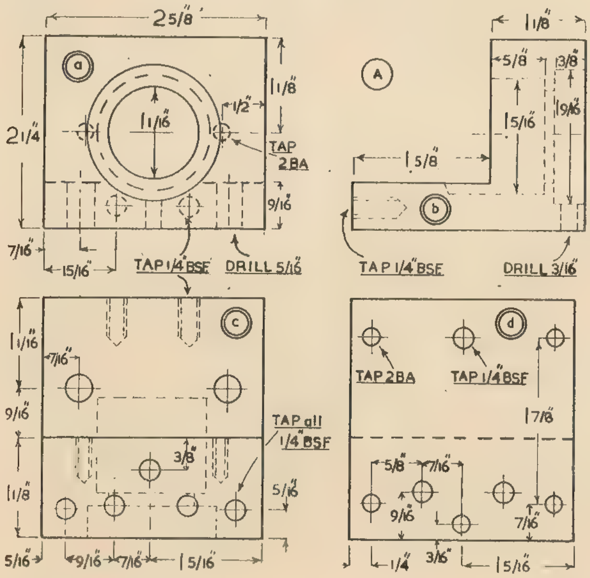
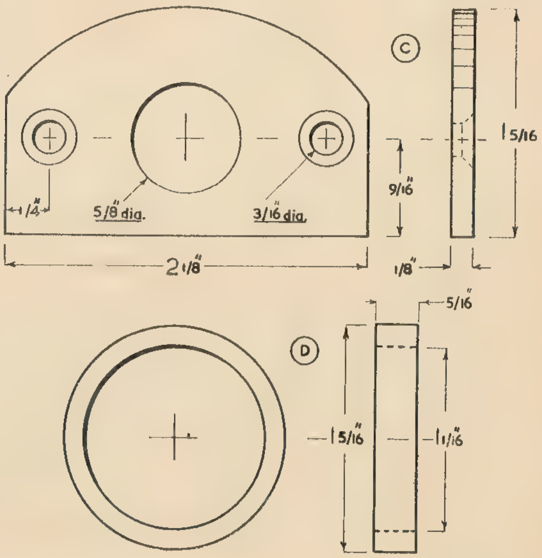


Fig. 6: The bearing clamp plate



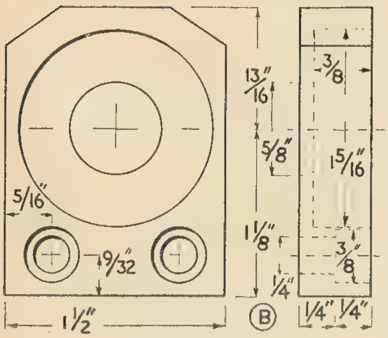


Fig. 4: Bearing housing bracket

be settled in arriving at the final design is the type of mechanism to adopt for converting the rotary motion of the primary drive to the reciprocating motion necessary for operating the file fitted to the machine.

The usual construction consisting of a crank, a connecting rod and a crosshead guided by a slidebar is perhaps the ideal solution from a purely mechanical point of view, but such a design has the disadvantage that the vertical height of the machine is greatly increased where a connecting rod of sufficient length to minimise side-thrust is included in the construction.

However, at the expense of introducing some complication, this difficulty of excessive height can be largely overcome by adopting the type of mechanism used in the jig-saw that was described in previous articles published in this journal.

An alternative mode of construction makes use of the compact and comparatively simple type of mechanism that is a feature of the so-called Scotch crank. There are objections, mainly on the score of excessive wear, levelled against this mechanism, particularly when it is used in its simplest form with a plain crankpin engaging in a sliding die-block and no provision is made for adjustment or taking up wear.

Fig. 3: Machining the ball-bearing housing in the casting

Nevertheless, this type of mechanism is fitted to various machines designed for commercial use and is, therefore, presumably not mechanically unsound. Although this form of construction had not previously been incorporated in any of the various machines designed and made in the workshop its adoption in the present instance was regarded as setting an interesting workshop problem if the weaknesses of the system were to be avoided.

It is perhaps fortunate that, in accordance with expectations, the finished machine runs at sufficiently high speed without appreciable vibration; that the lubrication of all bearings is well maintained and that the working parts are kept clear of filings.

Moreover, the components of the Scotch crank mechanism show no evidence of wear although the machine has had considerable use.

As shown in Fig. 1, the attachment is bolted to the lathe cross-slide and is driven by means of a short V-belt from a pulley gripped in the self-centring chuck; this has the advantage of bringing the machine nearer to the operator and affording an easier working position.

THE CONSTRUCTION

The first part to be taken in hand is the base casting, *A*, and in this instance use was made of the casting previously designed for constructing the pair of dividing heads recently described in this journal. Built-up construction could be adopted, but the important datum surfaces are more easily set out and machined where a rigid one-piece casting is used.

Subsequent machining and assembly will be facilitated if the casting is squared up on all faces and those that pass scrutiny with a try-square are marked to serve as datum surfaces for marking-out the cross-centre lines of the bearing housings as well as the centres for the reciprocating spindle that carries the file.

After the back of the vertical end face of the casting has been marked-out in accordance with Fig. 2a the part is secured to the lathe faceplate with the drilled centre of the bearing housing set to run truly with the aid of the centre-finder.

As the bearing housing bracket, *B*, is not cast integral with the main casting but is bolted in place, two-row self-aligning ball bearings are fitted to overcome any slight error of alignment during machining or assembly.

The lathe set-up illustrated in Fig. 3 shows that to obtain the necessary running balance two similar angle-plates are mounted in opposite positions on the faceplate. The housing is then machined to make the

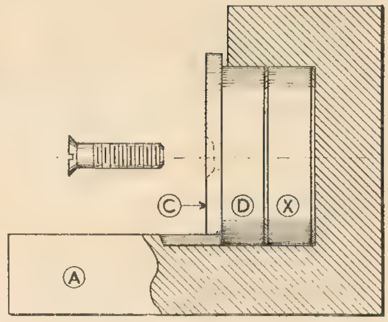


Fig. 7: Part-sectional view of the base casting: (C) the bearing clamp plate; (D) distance collar; (X) the self-aligning ball-bearing

bearing a push fit. It will, however, be noticed that owing to the restricted size of the casting the housing encroaches on the base to enable the bearing to be fitted in place.

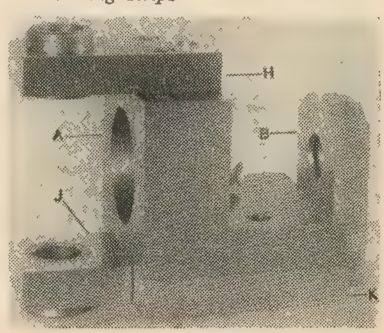
The casting is next reversed on the faceplate for turning the recess in which the crank disc revolves, but no high degree of accuracy is here necessary for ample clearance is provided on the machined surfaces.

The casting with the bearing bracket, *B*, bolted in place is rested on the surface plate and the bearing cross-centre lines are transferred from those previously scribed on the first bearing housing; for this purpose the two datum surfaces used in the first instance are again used in order to ensure uniformity.

After the bracket has been detached from the casting it is centre-drilled at the intersection of the two cross-centre lines and then centred on the faceplate for boring the housing to a firm push fit for the bearing. A close fit is here required to prevent the outer bearing race from rotating, for it is not clamped in place.

● *Continued on page 514*

Fig. 5: The base casting assembly: (B) bearing housing bracket; (H) the upper bearing plate; (J) the lower bearing plate; and (K) the bolting strips



READERS' QUERIES

Do not forget the query coupon on the last page of this issue

This free advice service is open to all readers. Queries must be on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope and query coupon with each query. Mark envelope "Query," Model Engineer, 19-20, Noel Street, London, W.1.

Machining blocks

I am constructing a $3\frac{1}{2}$ in. gauge *Doris* and to save expense and add interest I have been wondering whether I could machine the cylinder blocks for the main bore and for the piston valve from solid steel with pressed-in phosphor-bronze liners ?—H.H., Smethwick, Staffs.

▲ *It is doubtful whether you could make a success of cylinders machined out of solid steel with pressed-in phosphor-bronze liners. It will be much better to machine them straight out of solid phosphor bronze though this would, of course, entail far more work than the machining of the standard casting.*

Wire sizes

I am making an arc welding set from instructions in an American journal. I have been told, however, that it will not be possible to use the gauge wire specified, as the American and British s.w.g. differ. Could you tell me the corresponding British gauge to the American 3 and 8 ?

The transformer is designed to work off either 110 or 220 volts, depending on the connection. Is it possible to connect direct to 230 volts ?—M.V.K., Bradford.

▲ *There is no equivalent wire size to the American wire gauge. The nearest British standard sizes to the numbers you give would be 5 or 6 s.w.g. for your No 3 gauge and 10 s.w.g. for 7 or 8 gauge is the British standard for the primary winding.*

The gauge size for the secondary will be too large a diameter for winding by hand and where a size of this range is called for it is usual to use a flexible conductor of the same cross section the nearest to this would be a cable of 7/0.004—that is seven wires each of 0.044 in. dia. Either of these wires will be difficult to obtain outside the trade, but your best plan would be to contact a firm that carries out armature winding.

Another and simpler way to deal with a flexible secondary winding is to use a type of flexible bare cable with a cotton sleeving of a suitable size to cover it. There is a large range of flexible cables made, but none of them would be suitable for winding. As an alternative you could, of course, use strip copper for the same area; this laid up and taped would be quite satisfactory for the secondary.

Your transformer should be suitable to operate on the higher voltage of 230 volts. The percentage margin is so small that you could probably go up to 250 volts without serious trouble.

Garden fountain

I wish to instal a fountain in a small garden pond with the mechanism fully concealed. The idea I had in mind was to place an electric motor in a sealed box which would be sunk in the pond. Wound an ex-W.D. motor [A.M. rotary transformer, type 57, converted as suggested in MODEL ENGINEER some years ago] be suitable for this purpose ?—J.B.C., Rugby.

▲ *It would be quite practicable to enclose the motor in a sealed box and placed below the surface of the pond provided that it can be guaranteed to exclude damp and the possibility of leakage from glands or joints. The electrical insulation and earthing must, of course, be very carefully carried out.*

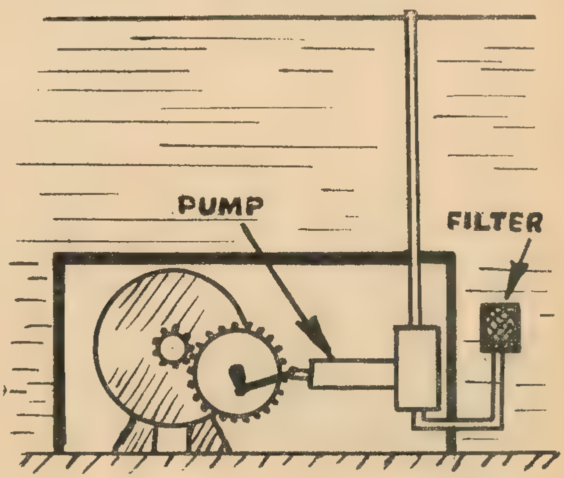
Your sketch suggests the use of a geared-down plunger pump, but it would be simpler and more satisfactory to use a centrifugal pump direct coupled to the motor. As there is no indication of the power which could be obtained from a converted rotary transformer it is not possible to advise you on the size of pump required, but centrifugal pumps well suited to this purpose can be obtained in a variety of sizes from Stuart Turner Ltd, Henley-on-Thames, Oxon.

It is also possible to obtain on the surplus market low-voltage motors with pumps incorporated and these would simplify installation besides reducing risk from electrical faults. The motor could be supplied with current by a transformer installed well above the height at which the water could possibly reach, so that high voltage risks could be completely eliminated.

Converted blowlamp

I have recently constructed a centre-flue boiler $3\frac{1}{2}$ in. dia. × $6\frac{1}{2}$ in., flue-tube $1\frac{1}{4}$ in. dia. × 9 in.; no water tubes are fitted. As I am new to steam power I seek advice on firing. Do you consider that a converted blowlamp would be sufficient, or, in the absence of water-tubes, would it be best to use a diffused flame burner similar to a Bassett-Lowke Paraflame burner ? The boiler has been tested to 120 p.s.i., and I hope to work a marine engine $\frac{7}{8}$ in. × $\frac{7}{8}$ in.—P.F., Frindsbury, Kent.

▲ *A converted blowlamp would be quite suitable for this purpose. As a matter of fact the diffused flame type of burner is not suited for burning inside a small diameter flue. As there are no cross tubes fitted to the centre flue of your boiler there is a possibility that heat might be wasted at the uptake end, and if you find that that is so by excessive temperature at the uptake, you might try inserting one or more of the asbestos "coals" as used in gas fires. Care must, however, be taken not to obstruct the area of the flue excessively.*



Proposed set-up of an electric-driven pump on a pond bottom

A ship modeller's diary

By JASON

About ten years ago there was started a Guild of Model Shipwrights which has existed continuously, in one form or another, ever since. It is exclusive in that it elects its own members. These members have a recognised status or standing among ship modellers.

It could be said that the Guild of Model Shipwrights is to ship modellers what the Society for Nautical Research is to shiplovers—but there the parallel ends. The membership of the guild is very limited, say, 24 currently, the subscription is quite modest and lately the meeting place has been in the workshop of one of our foremost and well-known ship modellers.

No rent is payable (due to the generosity of Mr Norman Ough) and consequently the financial state is normally healthy.

But the guild aims at being a learned body. Quite naturally members from time to time read papers. Due to the good offices of Wembley Ship Model Society these papers, or some of them, reach a wider public via the *Sheet Anchor* in the form of a supplement.

Now 12 members reading a paper apiece are, at the end of 12 months, due for a second paper. Even a duplicated publication costs money; so does postage. Hence the appearance of a crack in the policy.

What about the Society for Nautical Research? It has over 1,000 members and no restrictions on membership apart from the simple one of interest in ships. There is a printed, well-illustrated and exceptionally well-conducted magazine, *The Mariner's Mirror*. The subscription is higher and the wide membership exerts pertinent criticism on all items published in the official journal.

How do these facts impinge upon the policy of the guild? What does the crack portend? Obviously a limited membership means a limited income. A small income does not permit the expense of a publication, even a duplicated one. A number of members do not like the idea of open membership; they think it would be deleterious to the existing guild. Associate members, it is said, will solve the question.

I have been talking to the editor of MODEL ENGINEER and I have been assured that, notwithstanding what has happened in the past, any such papers submitted will be considered sympathetically for publication. Moreover, no objection will be offered to the writer describing himself as being a member of the Guild of Model Shipwrights. Payment, of course, will be made at the usual rates. This seems fair to all concerned.

The "Cutty Sark"

Further to Mr Carr's most interesting yarn about the world-famous *Cutty Sark*, here is a reminder to all that the Queen opens this ship to the general public in June. This follows upon the complete restoration of the ship, literally from keel to truck.

Aided by a splendid set of slides Mr Carr showed progress in the work from time to time as well as pictures of the ship at various stages in her career of nearly 100 years, for she was built in 1863 on the Clyde. I was particularly interested to see a picture of her rigged as a barquentine while under the Portuguese flag.

It is not generally known that she was composite built, i.e., iron frames and wooden hull. Mr Carr says that he had much luck in digging out the necessary details of her original rigging but his hearers ought not to forget that the "luck" was backed up by terrific persistence and much hard work on his part.

I understand that the members of the Thames Shiplovers' and Ship Model Society will be conducted round the ship the previous day to the Royal opening. Lucky Thames Shiplovers.

New Ship Model Societies

Letters have gone out to some half-a-dozen new districts and out of the score of letters posted only a couple were returned by the dead letter office.

Readers may remember Mr Harrison of New Southgate telling me of his five years' work on a model of the *Cutty Sark*. Within a few days he had a caller who, a few years ago, completed a model of the *Cutty Sark* thereby gaining a bronze medal at the M.E. Exhibition. The visitor lived scarcely more than a mile away.

I fully expect to see a flourishing ship model society in the district before many months have passed. This will cover the area Enfield to Tottenham and Southgate to Edmonton.

Seasoning wood

A letter from Mr F. D. Skinner, whose Royal Barge is remembered for its finish at last year's exhibition, asks the question about cutting logs and seasoning the wood. As Mr Skinner deals with small logs 9 in. dia. the method is simple.

Rip the log into planks or boards of convenient thickness, say 1 in. A general rule for seasoning wood is a year per inch of thickness. The boards should be laid upon each other with a thin lath at each end to keep them apart for the free circulation of air. A good place for storage is the garrett space above the rafters.

For bigger logs, 15 in. or more, it is best to get expert advice as to cutting. This is best done at the sawmill, especially if dealing with fine hardwoods.

The Stationery Office has a number of excellent publications dealing with timber from all parts of the world; your local library can be of great help in this connection. Some woods will cure outrageously even when properly cut but such publications will show the great advantage of quartering the logs. And don't forget that the saw cut itself is waste, perhaps as much as $\frac{3}{16}$ in. thickness, according to the type of saw used.

Artificial seasoning (by chemical methods) is extensively used by modern timber merchants. They have all the appliances for this so don't forget to have a chat about it.

This year's exhibition

Secretaries should note that the Model Engineer Exhibition is from August 21 to 31 inclusive. Write to the exhibition manager, J. Kreps, at 19-20, Noel Street, London, W.1, for the entry forms for your members. Make certain that the name of your society is on the form. Be sure to explain the difference between the conditions governing the Club Team Cup and the Maltby Trophy to your members.

The cup is awarded for the aggregate points for the three best entries from any established society; this is a matter for the judges. The trophy, on the other hand, is for the total number of points for all the models entered from an established society. It is solely for ship model entries whereas the cup may be won by locomotives, aeroplanes or a mixed selection.

Points here mentioned are those allocated annually for championship cups, special cups, medals and diplomas by a special meeting of the judges before the judging starts. ■

POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

J.N.M. REPLIES

SIR,—While S. V. Peyton [Postbag, March 14] is correct regarding the Wheatley 4-4-0 engines of 1871 for the North British Railway, it has been conceded in locomotive circles for many years that the first expression of what became the *typically* British inside-cylinder 4-4-0 express passenger engine was, as I said, the Glasgow and South Western design of J. Stirling. My authority was Mr Stirling himself.

As to Major Ind's comment, I possess a book containing an almost complete set of official weight diagrams of Great Eastern locomotives; the one depicting the Holden rebuilds of the No 1 class is dated 1881. Is it possible that this is a typographical error for 1889? I have no alternative source of information from which to check it.

W.1. J. N. MASKELYNE.

GOOD RESPONSE

SIR,—This is to thank you for publishing my letter re transport for our Annual Rag on April 13 [Postbag, March 7].

I have already received an offer of a steam-engine from Yorkshire, to say nothing of other offers from nearer home. The response is far greater than I ever expected.

Acton Technical
College Students'
Union E. A. RUDOLPH.
London, W.3.

CARBURETTORS

SIR,—I am sure many readers will be very grateful to Mr Westbury for his exposition of early carburettors. This is an important matter which is not at all adequately treated in the existing literature on the development of the early i.c. motor car. An informative treatise on the subject should become a standard work of reference.

I agree with Mr Westbury that the earlier textbooks are more interesting *and informative* for the simple reason that in modern textbooks far too much is taken for granted and an absurdly high standard of technical education seems to be assumed on the part of the reader.

Mr Westbury's Fig. 1 of the Benz surface carburettor does not appear to be quite complete as it stands. I assume that for such a device to work the level of the fuel must be regulated within certain fairly narrow limits. Yet there seems to be no means of regulating the level. If such a device were fed from a larger tank by gravity it would fill up and, presumably, overflow through the hole where the indicator float road enters the casing.

What in practice was done about this? Was there some sort of external float chamber or ballcock device?

W.1. JOHN H. AHERN.

Mr Westbury writes:

The Benz carburettor, in common with many other early types, had no automatic control of fuel level. The spherical float, B, seen in the centre of the carburettor (Fig. 1, p. 312) served only as an indicator of the amount of fuel in hand; when it fell below a certain level it was necessary to replenish the fuel by opening a cock on the main tank. Similarly, the float, D, in the De Dion carburettor (Fig. 2) served as a guide to the adjustment of the deflector plate, H.

THE "CLOUGHA"

SIR,—I enclose a print of my model tug *Clougha* on which you were kind enough to publish a short article on 28 June 1956. I have now nearly completed a 5 ft sea-going cabin-cruiser which is radio-controlled.

Ingleton. C. FARMBOROUGH.

NOT ECONOMIC

SIR,—With reference to J. L. Harden's query regarding the continuance of research into the steam-engine [Postbag, March 7] may I point out that to produce a reciprocating force and convert it into a rotary force has never been an economical proposition but a means to an end.

Many types of rotary steam-engine were made more than 50 years ago. Willans made some but they were not a great success. I love the steam-engine in all its forms and I am still fortunate enough to have one still working under my charge but, like the cart-horse, its days are numbered.

Salisbury, Wilts. M. SPEAREY.

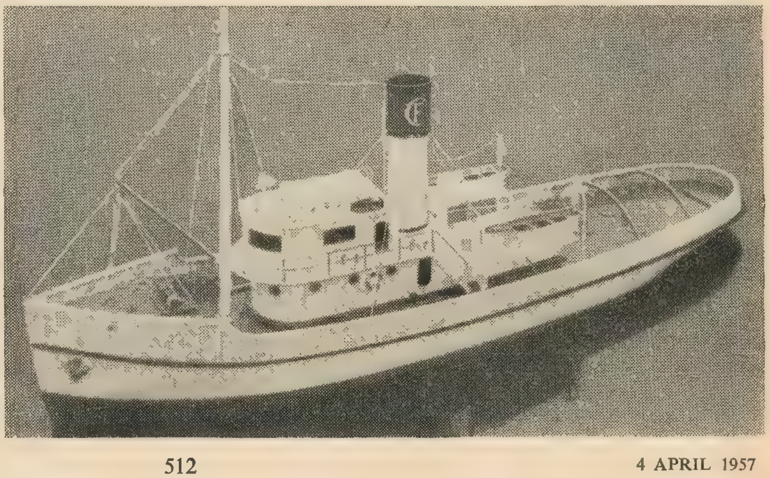
TURNING A CRANKSHAFT

SIR,—I would like to refer to two letters in Readers' Queries of March 7.

First, with regard to the query on crankshaft machining, A.C.M., Farnborough, I recently commenced to make a Stuart 10 V-engine. It was my first attempt at turning a crankshaft and I bent it badly. I decided to adopt the following procedure.

A piece of flat-bar stock (bright) was produced, the width of which was a little more than the throw, and the thickness a little more than the diameter of the shaft. This was cut

Mr Farmborough's model tug CLOUGHA



1 in. longer than the finished lengths, and two centres were drilled in each end, corresponding to the main shaft and the crank.

I marked out the position of the crank webs and made two hacksaw cuts on the inside of the webs nearly down to the crank and drilled this piece out. The bar was placed between centres (using the crank centres) and the inside of the webs faced and the crank turned to the finished size. (I used a parting-off tool).

As there was no more use for the crank centres, the unwanted material on the outside of the webs was cut away with a hacksaw, the crankshaft was placed between the other centres, the outsides of the webs faced and the mainshaft turned to finished size and cut to length.

A considerable amount of time is saved by cutting away the unwanted pieces instead of turning them away.

Regarding the query on a two-purpose compressor from J.S.S., New Malden, about the need for compressed air for a gas blow torch, I have recently had installed a large gas main, with a tap in the garage, for the purpose of brazing. I have bought a brazing torch and I find that a tube connected to the outlet of the vacuum cleaner and attached to the torch will supply air at about 2 p.s.i. and this is adequate for brazing ⅜ in. dia. rounds, etc.

I have also built a small portable hearth, and using the new smokeless fuel together with the blowtorch, find that heavy sections can be brazed satisfactorily. In fact, I have made a melting pot and if this is covered with a small piece of asbestos sheet and the coke heaped on top it is possible to melt brass.

I have explored the possibilities of using an oxygen cylinder and I would definitely recommend J.S.S. not to bother as (1) he will have difficulty in obtaining insurance; (2) there is a rental on all bottles of oxygen and gases and this works out very costly unless you are consuming a fair amount.

Stretford, Manchester. COLIN F. CAVE.

SYNCHRO ON BOTTOM

SIR,—I cannot agree with Vulcan's remarks under "Sorting them out" [Smoke Rings, March 7].

In the older Vauxhalls (1950/56) the change into bottom is not easy, but it is certainly not impossible while the car is moving. A change into bottom at any speed from nil to 12 m.p.h. can be made quietly and smoothly nine times out of ten by a competent driver.

I think the reason the new Victor has synchromesh on bottom is the rearrangement of gear ratios. The older Vauxhalls rarely needed bottom gear and 12 m.p.h. was the maximum convenient speed in it. The Victor will do 27 m.p.h. in bottom (*vide*: *The Motor*, March 6). This makes it a much more useful gear.

The gearbox must suit the engine. The Vauxhall engine produces maximum torque well down on the power curve and would not benefit greatly by more ratios. Engines which produce maximum torque high up on the curve must have more ratios and use them more frequently and, therefore, need a quick and easy change mechanism.

The original B.R.M. is the extreme example of this. It had five speeds and could have done with seven.

Sidmouth, Devon. S. LLEWELLYN JONES.

GENEROUS HELP

SIR,—Mr Steven's letter [Postbag, November 22] made very pleasant reading. I can sincerely endorse all he has said concerning Mr Reeve.

While attempting to build the Year Clock described by Mr Reeve in MODEL ENGINEER 26 July 1951, I had many examples of his kindness and generosity.

May I congratulate MODEL ENGINEER on publishing the constructional details of Mr Reeve's original longcase clock with chiming, striking and musical movements, the selection of this design merits wide acceptance and appreciation.

Christchurch, New Zealand. GEO. SMITH.

SHOWING THE WAY

SIR,—Although I have been a devout reader of MODEL ENGINEER for 18 years I have never written to you before but as I have entered the competition I should like to take this opportunity of thanking you for the pleasures and instructions you have so ably presented over all these years.

I am a turner employed by Rolls-Royce and your weekly articles are sometimes hotly debated and severely criticised by my colleagues.

I think the reason I have never written before is because I am in full agreement with your views.

Although I appreciate that the bulk of your readers are steam fans I would like to see more attention given to workshop tools and the use of same.

While not decrying the steam articles —in fact L.B.S.C. and Edgar T. Westbury have provided me with hours of interesting reading—I believe that if model engineers could be induced to care for their tools and equipment and shown that the production of a small jig, collet, adapter or means of making or simplifying a job amply repays itself in the finished article then the standard of workmanship of exhibited models could steadily increase and MODEL ENGINEER would once again show the way.

Nottingham. G. E. BRADLEY.

THE GOOD OLD DAYS!

SIR,—I am in entire sympathy with the last paragraph of Mr Gates's letter [Postbag, February 28] in which he refers to MODEL ENGINEER gradually getting back to the old standard. I would complain that it is not getting back fast enough.

I feel sure I am voicing the opinion of most of your readers in saying that we look to the M.E. for the know-how on models and modelling. If information on full-size engineering projects and general topics is wanted, there are many publications to meet the need.

Sutton, Surrey. T. V. S. MAGGS.

SIR,—I always felt it to be a mistake to make a separate publication for *Ships and Ship Models*. It robbed MODEL ENGINEER of interest value. Most of us are not one-track minded; we can derive pleasure from the other chaps' achievements, and share his interest if not his skill.

Perhaps in these days of intense specialisation in our daily work, the relaxation of versatility was never of greater value; the world, and the world of models, is so full of interest that life is too short to waste on a mental mono-rail.

I congratulate you on including *Ships* again. The family is more united by it, the fraternity less divided. Let us enlarge the spirit of mutual interest within our sphere of craftsmanship. Give us wide versatility and sweeping vistas over which our minds may roam.

Barton, Bedford. F. O. BROWNSON.

SIR,—I think Michael Skinner [Postbag, February 28] is very unjust to say that the ship modelling fraternity has not been welcomed. In this issue

Points from letters . . .

Gordon Rosekilly, of California, sends us the remarkable fact that the 8 and 12 ton locomotives used on the Wildcat Railway, which we featured recently, have never been in steam though they are perfect models.

* * *

One of the reasons for not fitting all locomotives on British Railways with steam-turbo generators is that there are not sufficient electricians in the sheds to service the equipment, observes H. Forster, of Co. Durham.

POSTBAG . . .

[March 7] three-tenths of the major articles are devoted to shipping. Ship modellers also had a proportionate number of articles in the mixed sections.

The editor has a difficult job to please everyone and I think he has done his job well. The only reply to Mr Skinner's reference to "derelict tractors" is that galleons are just as derelict.

Pulborough. PETER HUGHES.

DOMESTIC HEATING

SIR,—I am experimenting with a vaporising oil burner on a hot-air producing boiler, which formerly used coke, for central heating.

Normally I would never use vaporising oil burners because there is a constant trouble from clogging carbon due to an incorrect air/fuel mixture which can never be rectified on this type of burner. An air-pressure burner is the only kind to use.

As regards household hot-water boilers I expect I may cause some controversy by asking whether water-tubes or firetubes are the most efficient. It seems to me that many domestic boilers are inefficient as most of the heat goes up the chimney. Designs have stayed the same for 50 years.

To gain efficiency perhaps a combination of both water and firetubes in a fairly high boiler would be best.

Haslemere, Surrey. R. P. YATMAN.

9 FT CYLINDER

SIR,—I was very interested to read Vulcan's Smoke Ring ["Thank Maudslay," February 28] as my late father worked a heavy centre lathe in the upper turnery at the Westminster works for some ten years during the last century and well remembered some of H.M.'s early lathes with their individual leadscrews standing in racks in the works.

One of the last jobs on which my father was engaged was a set of triple-expansion engines for a Russian battleship. The low-pressure cylinder was 9 ft in the bore and my father had the job of machining the rings.

Fordingbridge, Hants. S. JEFFERIS.

VELOCITY AND FORCE

SIR,—Mr Stehelin [Postbag, February 28] says that it is a well-known fact that a waterspout grows downwards. Chamber's Encyclopaedia describes a waterspout as a *rising* column of air *whirling* about its axis and containing *water* spray.

As I am not well educated there may be some confusion of words, but I understand velocity to mean high speed, and that speed is relative. The facts and figures in my first letter I took from a mechanic's periodical in which there was an article on America's tornadoes; they were confirmed by information gleaned from the book *Scientific Knowledge*.

Our normal winds are 10 m.p.h., our severest hurricanes seldom reach 100 m.p.h., so when we speak of air speeds of 500 m.p.h. surely we may be allowed to use such terms as "tremendous" or "terrific."

It requires force (energy) to set matter in motion (speed, velocity) and it takes an equal amount of force to stop this motion. Therefore force and velocity are related. Where, then, is there anything which is not in accordance with scientific law?

Maidstone, Kent. C. E. HOOKER.

THE STEAM-ENGINE

SIR,—I should very much like to comment on Mr Harden's letter [Postbag, March 7], with which I most heartily agree.

My working life, which has now passed the allotted span but is still going, has been spent in charge of almost every branch of mechanical engineering, other than aeroplanes, motor cars and machine tool construction. The conclusion I have reached is that if a minute fraction of the effort put into disparaging development of the steam-engine and worshipping at the shrine of the conventional had been spent in improving its efficiency, steam would not be a spent force in transport, or other directions.

Paragraphs four and five in Mr Harden's letter are very much to the point. As a matter of fact the modern small double-acting engine as built in these islands takes nearly double the steam per b.h.p. that was needed in 1884 in my father's earlier type of engine and nearly four times that required by the 1904 White steam-car engine.

How many steam-engine builders have taken the trouble to read papers which exist in which tests on the White power unit are described?

I have read the MODEL ENGINEER off and on since my schooldays but only recently have I started to subscribe when it became apparent that sarcastic remarks about pioneer work, and what almost amounted to mud-slinging, were definitely discouraged. In my opinion basic improvements to steam-engine design lie hidden in the workshops of many amateur and professional engineers and particularly among those who have designed and built flash-steam units for model speedboats.

The National Research Development Corporation recently spent a very large sum of money on a steam power unit. I do not for one moment decry the attempt to produce such a unit. I felt at the time and still feel that had the N.R.D.C. called into its councils certain editors and asked them to organise competitions to (*a*) produce designs and (*b*) produce prototypes of approved designs discovered by (*a*) the ideal unit would have been forthcoming at a fraction of the expenditure.

Coming down to concrete facts, there is room for a steam power unit for a 20 ft launch burning solid fuel. What about a competition to produce the design for such a unit to be capable of being built on a 3½ in. centre lathe?

Devizes, Wilts. KYRLE W. WILLANS.

EXPERT'S WORKSHOP

Continued from page 509

The faceplate is to be preferred when setting up work of this kind, for four-jaw chucks when worn not uncommonly allow the work to lift away from the faces of the jaws when these are fully tightened.

Where a spindle is mounted in ball-bearings the correct procedure is to make both the inner and the outer race of one bearing captive by being securely end-located; the inner race of the second bearing is clamped in place on the spindle, but the outer race is left free to slide so that it can position itself to meet changes of temperature after the final assembly.

To secure the outer race in the housing bored in the casting the clamp plate, *C*, is held in place by two 2 B.A. screws.

As the casting is machined to locate the ball bearing as close as possible to the crank disc that imparts a reciprocating motion to the file, it is necessary to fit the distance collar, *D*, to form an abutment for the clamp plate, *C*, that serves to end-locate the bearing. The arrangement of the various parts is shown in Fig. 7.

It will be found best to use one's discretion when it comes to drilling the numerous holes in the main casting, for some workers prefer to clamp the parts in place to serve as drilling and tapping guides; but accuracy is not difficult to attain, following accurate marking-out and the use of a really sharp centre punch located by means of a magnifying glass at the exact intersection of the scribed lines.

Before entering the twist drill it is essential to enlarge the centre mark with a small centre drill, otherwise the indent made by the punch may not act as a reliable guide for the aris at the point of the larger drill.

● *To be continued.*

Reversing by radio *Continued from page 499*

Oil-bath lubrication is of course employed, and I recommend the use of a light oil, such as Shell Vitrea, so as to keep down losses due to fluid friction. It is of course necessary to fit an air vent or breather to the top of the box, but I have not shown this as its position will have to be arranged so as not to interfere with any control gear fitted to the cover. The box should be filled to a depth of ½ in.

Various modifications of the details of the gearbox may suggest themselves to readers but the general design, in which all really essential features are incorporated, can be guaranteed reliable and efficient.

One point which should be noted about reverse gears of this type is that the gears are only under load when actually in reverse, which will normally be no more than a very small proportion of the total working time; when running ahead, the gears run idly and the only losses are those due to running friction and oil drag, which can be kept very low; thus there is no appreciable reduction in the performance of the boat. ▣

FOR SHIP MODELLERS

Muncaster models . . .

Continued from page 490

components in model engines which could be produced more efficiently and economically by hand forging than by any other method, and a revival of this skill would be well worthwhile.

The crankhead bearings or "big ends" of both engines are of the solid box type, with split brasses of rectangular section fitted. These were usually secured by a tapered gib and cotter, which enabled the bearings to be adjusted for wear; but Muncaster shows them simply located in place by a screw, which passes through a notch in the rear half-bearing to prevent its moving sideways. The front half would presumably have side lips to engage the sides of the box frame for the same purpose; removal of the screw would enable the rear half to slide back enough to withdraw it over the collar of the crankpin.

Governor gear is fitted to the first engine, and could be adapted to the second if desired; some further information on this subject will be given later.

Two further examples of horizontal stationary engines are illustrated in Figs 24 and 25. Each has its own distinctive features, but many of the working parts are similar or identical; the cylinder dimensions are 1½ in. bore × 1½ in. stroke, which may be considered on the large side by many constructors, but it would be quite practicable to reduce the scale to half these dimensions or even less if desired.

The first of these engines has a crosshead of the slipper type, working on a slideway machined on the top surface of the bedplate, with keep plates secured by three studs or bolts on each side. A rather unusual method of fixing the cylinder is employed, the underside of the casting being provided with four projections or feed, into which setscrews or studs are screwed from the inside of the bedplate.

In addition, two vertical lugs are extended upwards from the bedplate and drilled horizontally to take extensions of two of the cylinder cover studs. This undoubtedly gives additional strength to resist working stresses, but may be regarded as "gilding the lily," to use a popular misquotation.

The height of the cylinder, crosshead and main bearing centres must all be exactly the same, and careful adjustment in machining or fitting will be necessary to ensure this. A very slight error in the height of the shaft centre would not be harmful; but any misalignment of cylinder and crosshead would cause binding of the working parts, and possibly gland trouble.

Errors of this kind are often botched up by makng the parts a sloppy fit, which certainly enables the engine to run, with sundry clanks and groans, but such slovenliness should never be tolerated in model engineering.

In the second example, Fig. 25, a bored "trunk" guide is employed, similar to that which I have described for the Theseus and Perseus engines, and this enables all uncertainty in the alignment of cylinder and crosshead to be eliminated, so long as machining is properly carried out. The trunk in this case is cast integral with the baseplate, therefore, unless special machining facilities are available, it will be necessary to mount the casting on the lathe saddle, packed up to the exact centre height, for boring the guide seatings and facing the rear flange.

It can then be swung round for boring the main bearing housings, the caps of which should previously have been fitted, and facing both their inner and outer sides. All these operations can be carried out with boring bars between centres, and fitted with suitable cutter bits. The centre lines of the trunk and main bearings must be exactly at right angles to each other.

It will be noted that the bearings of both engines are of the same type, also the crankshaft, which may be either machined from the solid or built up as indicated in the details included in Fig. 24. The journals and crankpin in this case are made a press fit in the webs, and accuracy should be checked after assembly, positive location then being ensured by fitting pegs or dowels endwise as shown.

The front end cover of the cylinder (Fig. 25) is sandwiched between the flanges of the cylinder and the trunk; it must be accurately machined on both sides, including the boring of the gland, to avoid introducing alignment error. I have described how to ensure this in connection with previous engines.

In other respects, the components of the two engines are identical, including the connecting rod and crankhead bearing, eccentric sheave, strap and rod (Fig. 24), and the slide-valve with its rod and knuckle (shown in Fig. 25); it will be seen that the method of attaching the valve to the rod, to allow free "floating" location, is the same as in the Theseus and Perseus engines; namely, by reducing either the width or diameter of the rod to fit a slot cut in the back of the valve.

● *To be continued.*

CLUB NEWS

★ Edited by THE CLUBMAN ★

NO ONE who visited the Northern Models Exhibition at Manchester can have any doubts of the keenness which invigorates the modelling movement in that area. The whole top half of England tells much the same story of a winter profitably spent and of eager new plans that the spring is bringing to life.

Here, for instance, is excellent news from the Midlands. **Nottingham S.M.E.E.** is an old society, and its members have always longed for an outdoor track of their own without being able to get one. Now, just in time for the light evenings, they have the multi-gauge layout of their dreams.

"For many years," writes secretary T. B. Glover (35 Wollaton Vale, Beeston, Nottingham), "we had neither the money nor a suitable site, but we laboured on in faith and hope. We worked hard to raise the money, and when we saw daylight and hope of having enough money in the foreseeable future, we started to look round for a site. This went on for a few years, and meanwhile we became richer.

"We almost closed on several sites which were 'not quite.' Pros and cons were weighed against our urgent need, but each time we decided to hang on until we had just what we wanted. How glad we now are!

"Last year the perfect site turned up, and now, under the able direction of E. S. Wright, our outdoor track supervisor, we have almost completed an 860 ft multi-gauge track which we hope to open officially in April or May of this year. We now have a fine clubhouse alongside the track, set amid flowering shrubs. A stream of pure water, which will ensure an adequate supply for the locomotives with a little left over for brewing tea, forms the boundary of our side of the site."

To president A. J. Whitty, a founder member, this achievement is one to be honoured, and in testimony of his appreciation he has presented the society with a silver cup to be competed for annually and awarded for the best performance on the track by a member's locomotive. The Live Steam Cup, as it will be known, should stimulate interest in building locomotives which (says Mr Glover) "have that little extra which others haven't got."

As soon as the opening date has been fixed the society will invite its friends up and down the country to share its pleasure in this good fortune. Meanwhile Tommy Lawson, back from the frozen North—County Durham, to be precise—is to give a talk on *James Milne*, known to the society as "Uncle Jim's masterpiece." All visiting friends are more than welcome on April 24.

SCRAPHEAP TYPEWRITER!

We also find plenty of vigour and enterprise well up in Mr Glover's "frozen North," at West Hartlepool. Members of **West Hartlepool S.M.E.** are now having a bi-monthly news sheet, produced by J. Snowdon with a typewriter made by himself from parts of two machines which had been consigned to a scrapheap! He does not complain of the cost; at five shillings a typewriter is cheap nowadays.

And when the club held a competition in aid of funds the prize was a man's wrist watch constructed by secretary A. C. Lamb (9, Brus Corner, West View, Hartlepool, Co. Durham) from parts which he had accumulated from watches beyond repair.

At the annual meeting of this resourceful club the committee was re-elected with the exception of treasurer Paxton who has retired; he is succeeded by P. Wright.

Since the New Year opened talks have been given by Mr Lamb on watch movements, with the various types of movement fully explained and demonstrated, and by C. H. Cheslin, the public relations officer, on the history of the railways. At the March meeting the OO gauge section explained the new club layout.

Three teams of four have volunteered to continue work on the permanent $3\frac{1}{2}$ in. to 5 in. gauge locomotive track. The society hopes to finish all the concrete work this year. Then, with the sleepering and laying of track completed, all should be ready for steam up!

PACIFIC PRESENTATION

Model engineers in Bradford will want to see the $3\frac{1}{2}$ in. gauge Pacific locomotive modelled by the late Gilbert Bower of Bradford. Mr Bower died a year ago and his widow has presented this model to the Cartwright Memorial hall, together with another example of his craftsmanship, *Princess Royal*.

The Pacific forms the centre of a new permanent display. Seven photographs recall the modeller as his friends remember him, six of them driving his engines for the delight of children in the area. In years to come many men and women of the West Riding will find here a happy memory of their childhood.

Other photographs are of *Mallard*, *Sir Nigel Gresley* and *Dwight D. Eisenhower*, with specifications supplied by the public relations and publicity officer of North-East Region at York. It was, I understand, at the instigation of H. Underwood, who edits the bulletin of **West Riding S.L.S.**, that *Mallard* was fitted with her commemorative plaques.

M.E. DIARY

April 4.—Chingford and District M.E.C. Exhibition, Conway Hall, High Street, Walthamstow (April 4, 2.30-9.30 p.m.; April 5, 5.-9.30; April 6, 2-9. Eltham and District L.S. annual meeting, Beehive, 8 p.m. Sutton M.E.C. lecture by Edgar T. Westbury. I.E.E. Kelvin Lecture, Model Railway Club "Railways of the Isle of Wight," A. B. Macleod, Caxton Hall, London.

April 5.—Rochdale S.M.E.E. "Radio Control," W. H. A. Jones, Lea Hall, 7.30 p.m. North London S.M.E. Bits and Pieces, E.R. Gas Offices, New Barnet, 8.0 p.m.

April 6.—West Riding L.S. annual meeting, Y.M.C.A., Albion Street, Leeds, 6.30 p.m.

April 8.—Clyde Shiplovers' and Model Makers' Society annual meeting, Kelvingrove Museum, 7.30 p.m.

April 9.—Bristol S.M.C. "Rope Making and Splicing," E. Mountfort, Legion House, 7 p.m. I.M.E. Symposium on Superchargers, 4.30 p.m.

April 10.—Norwich and District S.M.E. "Pattern Making and Casting," R. E. Ward, The Assembly House, Theatre Street, Norwich, 7.30 p.m.

April 13.—S.M.E.E. Affiliation annual meeting, Lecture Room, S.M.E.E. Headquarters, 28 Wanless Road, London, 3 p.m.-5.30.

Model Engineer

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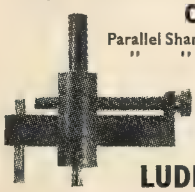

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ML7 Lathe complete with motor, 3- and 4-jaw chucks, drill chuck. Burnerd toolpost, £55, offers.—LAMB, The Fold, Stratford-on-Avon. 3878.

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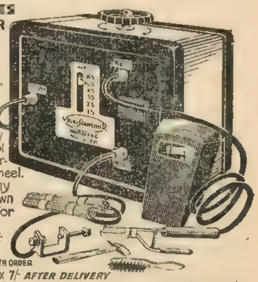

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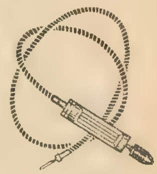

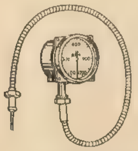

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Model Engineer

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	Month
Airing cupboard	Sept.
Barometer	July
Bathroom cabinet	Oct.
Bathroom stool	Jan.
Battery charger	Nov.
Bed table	Feb.
Bedside Bookshelf	Aug.
Bedside cabinet	Nov.
Bellows	Feb.
Bench top holding device	July
Bevelled table top	Dec.
Book rack	Feb.
Brick paths	Feb.
Candlesticks	Nov.
Car heater	Jan.
Car luggage trailer	Oct.
Car picnic table	Sept.
Chair repairs	Feb.
Christmas decoration	Dec.
Clothes airer	Jan.
Clothes drier	Dec.
Clothes post	Sept.
Coal bin	Sept.
Coal scuttle	Oct.
Coffee table	Aug.
Competition	Dec.
Contemporary armchair	Oct.

	Month
Contemporary bookcase	Jan.
Copper bucket	July
Crystal set	Jan.
Desk lamp	Dec.
Desk top repair	Feb.
Developing dish	Sept.
Doorbell chimes	Sept.
Electric food mixer	Sept.
Extending ladder	Nov.
Flush doors and pelmets	Sept.
Folding table	Dec.
Fountain pen repairs	Dec.
French polishing	Nov.
Garden roller	Aug.
Garden swing	July
Gas blowpipe	Dec.
Glove puppets	Dec.
Hair drier	July
Hall lantern	Oct.
House and garden tips	Dec.
House nameplate	July
Household steps	July
Inserting fence posts	Sept.
Iron gate stops	Oct.
ITV aerial	Feb.
Kitchen chair upholstery	Oct.
Kitchen dining table	Nov.

	Month
Kitchen drier	Feb.
Kitchen stool	Sept.
Lampshades	Sept.
Lino repairs	Feb.
Loft ladder	Sept.
Lock-joint attachment	Feb.
Loudspeaker cabinet	Nov.
Marquetry pictures	July, Aug.
Motorised lawn mower	July
Motorised sewing machine	Nov.
Multiplication game	Dec.
Music box	Aug.
Occasional table	Sept.
Ornamental firescreen	Feb.
Ornamental walls	Dec.
Photo frame	July
Photo lampstand	Feb.
Picnic chair	Aug.
Plant holders	Oct.
Plant pot holder	Nov.
Playpen/cot	Jan.
Poker	July
Portable cupboard	Nov.
Powder bowl	Sept.
Refrigerator	Aug.
Rose arbor	Nov.
Sawing stool	Nov.

	Month
Servicing vacuum cleaners	Oct.
Sewing cabinet	Dec.
Simple wrought iron	Jan.
Standard lamp	Jan.
Steel work bench	Nov.
Stepped table	Nov.
Stepping stone path	Jan.
Table bookcase	Feb.
Table lamp	Dec.
Table lighter	Oct.
Tap reseating cutter	Oct.
Tea tray, bed table	Dec.
Tea wagon	July
Tea wagon (marquetry)	Oct.
Tinted garden path	Oct.
Toys	Jan.
TV improvement	Jan.
Upside-down shelf	Dec.
Wall desk	Dec.
Wall desk	Jan.
Wall lights	Dec.
Wallpaper estimating	Nov.
Wheelbarrow	Sept.
Whisky cask	Aug.
Window box	Feb.
Wrought iron gates	Aug.
Wrought iron table	July

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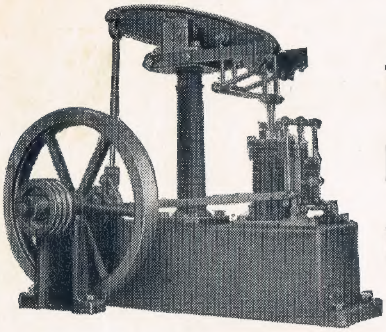
M.E. QUERY COUPON APRIL 1957



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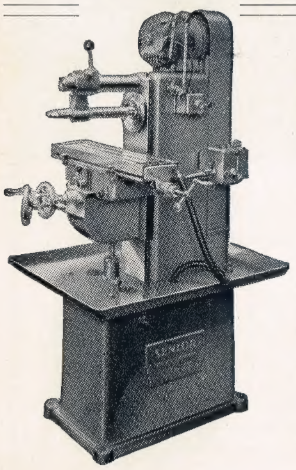

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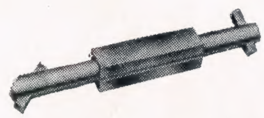

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